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Bibliography on Turbulent Diffusion and Exchange

February, 1953 · No. 2

# METEOROLOGICAL ABSTRACTS AND BIBLIOGRAPHY

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B. Bibliographic references to other items of interest to the profession.

C. Selective, annotated bibliographies on subjects of immediate and special interest to meteorologists.

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# METEOROLOGICAL ABSTRACTS AND BIBLIOGRAPHY

MALCOLM RIGBY, Editor

Vol. 4 FEBRUARY 1953 No. 2

INDUSTRY · ENGINEERING · AGRICULTURE · COMMERCE · AERIAL AND MARINE NAVIGATION · PUBLIC HEALTH ·
AMERICAN METEOROLOGICAL SOCIETY
1919

**SPECIAL FEATURE IN THIS ISSUE**

A Selective Annotated Bibliography on Turbulent Diffusion and Exchange

(*For complete table of contents see back cover*)

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# FOREWORD

Meteorological Abstracts and Bibliography is a monthly publication whose purpose is to ring to the attention of meteorologists current literature in their field and in related fields and provide bibliographic information on various subjects, as interest demands.

Part I contains from 175 to 300 abstracts of current periodical literature and monographs in ne fields of meteorology, hydrology, oceanography, etc. These abstracts are arranged ccording to the Universal Decimal Classification.

Part II of each issue comprises a special annotated bibliography of from 50 to 250 im- ortant references on a special subject without respect to recency of material. No attempt made to prepare exhaustive bibliographies; instead, the aim is to include a representative ross section of the various aspects of a subject. Preference is given to recent material, omprehensive works, material from obscure sources, and items with good bibliographies.

Bibliographies previously published were:

| No. | Mo. | Vol. I, 1950 | Vol. II, 1951 | Vol. III, 1952 |
|---|---|---|---|---|
| 1. | Jan. | **Atmospheric Pollution** | **Extended Forecasting** | **Climate—Northwest Africa** |
| 2. | Feb. | **Aerobiology** | **Long Range Forecasting** | **Carbon Dioxide** |
| 3. | March | **Cloud Physics** | **Soil Temperature** | **Climate—Paraguay, Uruguay, Argentina** |
| 4. | April | **Hail** | **Constants, Tables, Diagrams** | **Dew** |
| 5. | May | **Tornadoes** | **Climate—Near East** | **Objective Forecasting** |
| 6. | June | **Volcanic Dust** | **Climate—Middle East** | **Stratus Forecasting** |
| 7. | July | **Climatic Changes** | **Special Winds** | **Urban Climatology** |
| 8. | Aug. | **Thunderstorms** | **Radar Storm Detection** | **Climate—Central Africa** |
| 9. | Sept. | **Icing** | **Condensation Trails** | **Visibility** |
| 0. | Oct. | **Acoustical Propagation** | **Climate—Northeast Africa** | **Glaze and Rime** |
| 1. | Nov. | **Evaporation** | **Mountain Meteorology** | **Free Air Turbulence** |

Bibliographies published this year are:

1. **Turbulence Theory,** Vol. IV, No. 1, Jan. 1953
2. **Turbulent Diffusion and Exchange,** Vol. IV, No. 2, Feb. 1953

Forthcoming bibliographies will be:

3. **Frost and Frost Forecasting,** Vol. IV, No. 3, March 1953
4. **Climate of Australasia,** Vol. IV, No. 4, April 1953

Other bibliographies in preparation are:

*Actinometers*
*Arctic Meteorology*
*Auroral Physics*
*Climate of Southeast Asia and the East Indies*
*Climate of the Pacific Ocean Area*
*High Level Winds*
*Machine Methods in Meteorology*
*Microwave Propagation*
*Oceanographic Meteorology*
*Ozone*
*Radiation Bioclimatology*
*Snow Cover*
*Tropical Cyclones*
*Tropopause Variations*

Part III contains a listing of the contents of those journals which are primarily meteoro- gical. These are published in the earliest issue where space permits.

Part IV is made up of author, subject and geographical indexes. In the December issue umulative author, subject, geographical and journal indexes are published.

# EXPLANATIONS

**Location of material:** For each entry, a symbol is given for at least one library where t material may be found. The Union List of Serials (Gregory) is the source of most of t symbols used. In some cases, where no symbol has been assigned to a library, one will devised according to the principles of the Union List.

**Library symbols** used frequently may be found in the following list:

| | |
|---|---|
| **DA:** | U. S. Dept. of Agriculture Library, Washington, D. C. |
| **DBS:** | U. S. Bureau of Standards Library, Washington, D. C. |
| **DGS:** | U. S. Geological Survey Library, Washington, D. C. |
| **DLC:** | Library of Congress, Washington, D. C. |
| **DSG:** | U. S. Army Medical Library, Washington, D. C. |
| **DSI:** | Smithsonian Institution Library, Washington, D. C. |
| **DWB:** | U. S. Weather Bureau Library, Washington, D. C. |
| **GB-MO:** | Great Britain, Meteorological Office Library, Harrow, England. |
| **MH-BH:** | Harvard University, Blue Hill Observatory (and American Meteorologic Society) Library, Milton, Mass. |
| **NN:** | New York Public Library, New York, N. Y. |
| **NNA:** | American Geographical Society Library, New York, N. Y. |

**Other symbols:**

| | |
|---|---|
| * | before an entry indicates a good data source. |
| † | before an entry indicates a good bibliography. |
| § | before an entry indicates a synoptic case history study accompanied by chart |

**Geographic locations** are in the English form rather than the form used locally, for exampl Moscow for Moskva.

**Titles of articles or monographs** are in the language of the original article unless otherwi stated. Slavic (Cyrillic) titles are transliterated into the Roman alphabet according to t Library of Congress transliteration scheme.

**Abbreviations:**

*Titles of periodicals* are not abbreviated, as a rule.

The months of the year from March to July are not abbreviated. Other months a abbreviated as Jan., Feb., Aug., Sept., Oct., Nov., and Dec.

The word or abbreviation for Volume (Tom, Band, Jahrgang, Año, etc.), for Numb (Heft, Fascicule, Vypusk, etc.) and for page or pages is omitted from most entries. Thus a entry will read as follows:

*Meteorologische Rundschau*, 2(5–6):146–151, May–June 1950.

This indicates that the article appeared in *Meteorologische Rundschau*, *Jahrgang* 2 (V 2), *Heft* 5–6 (No. 5 and 6), *pages* 146–151, May–June 1950.

# PART I. ABSTRACTS OF CURRENT METEOROLOGICAL MATERIAL

## WORKS OF SPECIAL INTEREST

4.2–1 551.511:551.576.11

Brunt, Sir David (*Imperial Col. of Sc. and Tech.*), **Experimental cloud formation.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 1255–1262. 12 figs., table, 18 refs.) **MH-BH**—The history of the discovery of convection in cellular form in unstable fluids (Bénard cell) is reviewed. The experimental study of the properties of the simple convection cell involving the pouring of cheap gold paint into a highly volatile liquid medium is described and the theoretical treatment of LORD RAYLEIGH of the physical conditions producing a convection cell is summarized. An apparatus and procedure (CHANDRA) for studying motions in unstable layers of air having no general motion and motion in unstable layers having a shearing motion are described and the results of experiments showing the structures found in chambers of varying depths are shown in photographs. DASSANAYAKE's experiments on convection in carbon dioxide are summarized. The applications of experimental cell convection to convection clouds in the atmosphere and to the structure of the solar chromosphere is discussed and a paper of O. G. SUTTON's on the theory of Bénard cells is summarized. *Subject Headings:* **1. Cloud formation 2. Convective cells 3. Cloud models 4. Compendium articles.**—*I.L.D.*

4.2–2 551.506.67

†Coons, Richard D. and Gunn, Ross, **Relation of artificial cloud-modification to the production of precipitation.** (In: **Compedium of meteorology.** Boston, American Meteorological Society, **1951.** p. 235–241. 8 figs., 15 refs.) **MH-BH**—History of theory and practice of cloud seeding is reviewed, conditions necessary for successful artificial precipitation experiments outlined, and Cloud Physics Project of U. S. Weather Bureau, NACA and USAF described. Results of 170 controlled tests made by the project (1947–49) in Ohio, Calif. and Alabama are analyzed. Verification was by radar, aerial photograph and voice recordings of observers notes as well as by a ground network of rainfall stations and upper air soundings (rawinsondes). Examples are given in detail of seeding of stratus decks in Ohio, where cloud modification occurred but no appreciable precipitation could be attributed to artificial means, although a careless analysis might give the opposite impression. In California (Sierras) nonfrontal clouds were rarely observed. The only modification of orographic clouds was the dissipation of strips in cloud decks which later disappeared from natural causes. Since overseeding was postulated as cause for poor results, single pellet seeding was tried in 4 cases but without success. Furthermore the optimum amount of dry ice for successful seeding was difficult to determine, because of varying cloud depth; moisture content, divergence and diffusion rates. Very few cases of cumulus cloud seeding resulted in cloud growth or precipitation. In most cases, even where supercooled clouds had not reached the spontaneous ice crystal stage, the clouds tended to dissipate. Downward motion induced by cooling from seeding resulted more frequently than upward motion, when steep lapse rates existed. In the Gulf States the ice crystal level was reached so soon after the cloud top passed the 0°C isotherm, that supercooled, ice crystal free clouds were seldom available for a long enough time to carry out controlled tests. Most cases which were attempted resulted in accidental dissipation. Water seeding was also tried without conclusive results. A few successful attempts are described but more often the careful analysis of records showed that the actual precipitation was induced by natural processes, whereas the dry ice seeding inhibited the development of cumulonimbus. The conclusion is that seeding produces disappointing results from a commercial standpoint

but promises to be of considerable scientific value. *Subject Headings:* **1. Cloud seeding 2. Dry ice 3. Artificial cloud modification 4. Artificial precipitation 5. U. S. Weather Bureau Cloud Physics Project 6. Compendium articles.**—*M.R.*

4.2–3 551.515.2

Dunn, Gordon E. (*U. S. Weather Bur., Chicago, Ill.*), **Tropical cyclones.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 887–901. 9 figs., 22 refs.) **MH-BH**—A comprehensive and very well organized survey of the origin, structure and behavior of the various types of tropical cyclones, which are comprised of hurricanes, typhoons, cyclones, baguios and willy-willies. An outline of the classification of tropical cyclones according to intensity and to stage of development or life history is presented and the surface characteristics, such as air mass arrangement around the cyclones, pressure gradient, oscillation of atmospheric pressure or pumping, temperature, wind circulation, cloud arrangement, precipitation distribution around cyclones, the properties of the radar bands produced by cyclones, atmospheric conditions in the "eye" of the storm and its size and duration, the frequency of thunderstorms and tornadoes and the hurricane waves and hurricane tides are discussed. The section on the vertical structure of tropical cyclones contains a brief summary of theoretical views on the evacuation of air from tropical cyclones (theory of tropical cyclones is covered by H. RIEHL in the "Compendium," *see item* 4.2–13 below), a discussion of the height of tropical cyclones, the thermal structures and tropopause heights in tropical cyclones, various theories on the formation of tropical cyclones, the regions and season of origin and a summary of their frequency by month are presented. The monthly variation in the seasonal storm track, the forecasting of the direction of movement such as recurvature, the role of steering currents, the forecasting significance of storm swells, storm tides and microseisms are discussed. Needed research on tropical cyclones suggested includes: collection of upper air data over oceans, further statistical and physical analysis of meteorological elements around cyclones, relationship between computed cyclostrophic term of the gradient wind and observed wind, etc. *Subject Headings:* **1. Tropical cyclones 2. Compendium articles.**—*I.L.D.*

4.2–4 551.582.3(431)

Germany. Deutscher Wetterdienst in der U. S. Zone, **Klima-Atlas von Bayern.** [Climatic atlas of Bavaria.] Bad Kissingen, **1952.** 83 p. with 79 maps and numerous diagrams. 23 p. with explanations. **DWB**—Maps of the mean temperature, cloudiness and precipitation, of wind direction, fog, thunderstorm, hail and snow cover frequency, etc. are given for each month and for the year. Eight phenological maps, and diagrams showing the variability of temperature and precipitation in an effective popular form are added. The precipitation conditions are shown in great detail. Maps of the actual air temperature (showing mostly the influence of relief) are given for four months and for the year. A strong opposition exists in Germany against the international "*Normal period*" 1901–1930. Although this period could be used for almost all elements, the maps are based on different periods, mostly 1881–1930 and 1891–1930 for precipitation. The basic data for the maps are taken from: "Klimakunde des Deutschen Reiches" (Tabellenband, Berlin, 1939) but additional data, from the archives, are also used. *Subject Headings:* **1. Climate of Bavaria 2. Climatic atlases 3. Bavaria, Germany. I. Knoch, Karl.**—*A.A.*

4.2–5 551.510.534:551.508.952

†Götz, F. W. Paul, **Ozone in the atmosphere.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 275–291. 16 figs., 3 tables, 104 refs. 31 eqs.) **MH-BH**—Instruments and methods of observation are described. The horizontal and vertical distribution and the annual variation are given, and the principle theories on the origin of the atmospheric ozone are examined. The relationship of ozone distribution to the weather is shown. The constitution of the upper atmosphere and the bioclimatological importance of ozone are discussed also. *Subject Headings:* **1. Ozone variations 2. Ozone distribution 3. Ozonometers 4. Compendium articles.**—*A.A.*

4.2–6 551.582.3(41/2)

*†Great Britain. Meteorological Office, **Climatological atlas of the British Isles.** London, H. M. Stationery Office, **1952.** 139 p. 120 charts or diagrams, tables, refs. MO488. Price:

£2–12–6. **GB-MO**—This complete atlas of the climate and weather of the British Isles is based mainly on the period 1901–30. The sections include: Pressure (monthly mean charts, typical days, graphs of hourly pressure); Wind (speed and direction, gusts, wind roses); Temperature (monthly means and extremes, frosts, graphs); Rainfall (monthly averages, raindays, statistical data, heavy falls, duration, etc.); Snow; Thunder; Humidity (vapor pressure and rel. hum.); Sunshine; Fog and Visibility. Stations are listed and mapped. Each section is accompanied by descriptive text and tables and a bibliography. Most charts are in color, some present data on histograms. A valuable and attractive reference book. *Subject Headings:* **1. Climatic atlases 2. British Isles.**—*C.E.P.B.*

4.2–7 551.557:523.5

Greenhow, J. S., **A radio echo method for the investigation of atmospheric winds at altitudes of 80 to 100 km.** *Journal of Atmospheric and Terrestrial Physics*, London, 2(5):282–291, **1952.** 8 figs., 10 refs. **DWB**—The setup is described for recording echoes on 8.4 m from meteor trails. Winds deduced from drift of echoes had velocities around 50 m/sec, mainly from N before 0100 local time and from S after 0200. Trail distortion shows steep wind gradients superposed on this steady drift so that points 5–10 km apart may differ by over 50 m/sec. *Subject Headings:* **1. Upper air winds 2. Meteors.**—*C.E.P.B.*

4.2–8 551.594.25:629.13

Gunn, Ross (*U. S. Weather Bur., Wash., D. C.*), **Precipitation electricity.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 128–135. 2 tables, 29 refs., 8 eqs.) **MH-BH**—The most recent observations by the author and others, on the charges on various types of raindrops (quiet, shower and thunderstorm rain), on snow and on cloud elements, show the general pattern of sign and intensity of charges on various types of particles acting in various ways. There are many contradictions in past observation and resulting theory, but the causes of some of these variations in charge can now be explained. The processes responsible for such charges are divided into *basic processes* (frictional) freezing chemical, and the "waterfall effect" or breaking up process and *environmental processes* (selective capturing of charges by falling drops, rime deposition, and water vapor transfer) and *association processes*. The theory of free electrical charges, the importance of droplet size in determining the sign and degree of charge, and finally, the electrification of aircraft flying through precipitation are treated. Quantitative values for charges on various drop sizes and types, and for the electric field around such drops, according to various authors, are given in brief tables to show the order of magnitude of such charges. The charges produced by snow on airplanes, especially at very low temperatures, are more important than those produced in flying through thunderstorms because in the former case the effect is more prolonged (hours) compared with that of the latter (minutes). Results of investigations on charges produced on military aircraft in Alaska and elsewhere, and published in detail in reports of the Precipitation Static Project are briefly reviewed. *Subject Headings:* **1. Electricity of precipitation 2. Electrical charges on raindrops 3. Precipitation static 4. Aeronautical meteorology 5. Compendium articles.**—*M.R.*

4.2–9 551.510.42

†Hewson, Edgar Wendell (*Mass. Inst. of Tech.*), **Atmospheric pollution.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 1139–1157. 5 figs., table, 106 refs., 12 eqs.) **MH-BH**—A very comprehensive review of the meteorological aspects of atmospheric pollution by man made contaminants. The topics covered are as follows: 1) types of contaminants, namely particulate matter and gases and vapors; 2) measurement of atmospheric pollution by means of the deposit gage, the smoke filter, the Ringelmann chart, sulfur dioxide apparatus, ultraviolet daylight integrator and visibility; 3) atmospheric pollution by single source including the basic equations for determining concentrations near the source and distant from the source, the effect of atmospheric conditions upon concentration, the influence of topography upon concentration, the calculation of the deposition of particulate matter, the coagulation of particulate matter and the results of wind tunnel investigation on the effect of eddies induced by stacks and adjoining buildings; 4) pollution by multiple sources as influenced by atmospheric stability, by rain and topography, and the daily and weekly

variation; 5) the effect of pollution upon meteorological elements in particular rainfall and fog; and 6) the control of atmospheric pollution by limiting contaminants emitted, by stack height, by control of stack temperature, by varying the emission of contaminants as the diffusing power of the atmosphere varies and by the use of climatological planning in the selection of sites for plants producing contaminants. A brief summary of the trend in atmospheric pollution studies carried on in the United States and England is presented, the recommendations for control of atmospheric pollution and for specific research studies proposed by the U. S. Technical Committee on Air Pollution held in Washington, D. C. on May 3–5, 1950 are quoted and various suggestions on lines for further research made by N. R. Beers, Phil E. Church, G. M. B. Dobson, A. R. Meetham, M. E. Smith and O. G. Sutton are cited. An extensive bibliography is appended. *Subject Headings:* **1. Atmospheric pollution 2. Atmospheric pollution control 3. Compendium articles.**—*I.L.D.*

4.2–10 551.508.94:551.594.1/2:621.317

Israël, Hans (*Univ. of Tübingen, Germany*), **Instruments and methods for the measurement of atmospheric electricity.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 144–154. 10 figs., 152 refs., 10 eqs.) **MH-BH**—The system of units devised by Giorgi (m/sc, v-amp) is recommended by the author as preferable to the electrostatic or electromagnetic cgs systems used heretofore, as being more easily visualized than the other systems. The quadrant electrometer, Wulf's unifilar and bifilar electrometer and a vertical due to $\alpha$, $\beta$ and $\gamma$ radiation, conductivity, ion concentration, ion mobility, rates of ion formation and recombination, life of ions, condensation nuclei, dust particles, electric field of atmosphere, vertical currents, space charges, thunderstorm electric fields, currents, precipitation charges, lightning discharges, and radio interference and the measurement of all of these factors, are discussed and illustrated. The relation between meteorological processes and atmospheric electricity manifestations, which for several decades has been played down, is now coming into the limelight again as a result of discoveries based on the Carnegie Expedition as to the coupling of the world-wide electric field movements with large scale weather processes, and of local variations in electromagnetic parameters with vertical austausch. There should be a program of simultaneous and regular observations at high altitude stations, and at nearby stations at various altitudes, in different air masses, in or near thunderstorms or rain areas, and in the upper atmosphere. The study of sferics should also yield useful results in this field. *Subject Headings:* **1. Atmospheric electricity measurement 2. Atmospheric electricity instruments 3. Electrometers 4. Compendium articles.**—*M.R.*

4.2–11 551.594.14

†Israël, Hans, **Radioactivity of the atmosphere.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 155–161. fig., 6 tables, 63 refs.) **MH-BH**—Emanations ($\alpha$, $\beta$ and $\gamma$) from radioactive substances in the earth or air provide the principle source of ions which increase the conductivity of the lower layers of the atmosphere. Fifteen of these radioactive elements, together with their half-life and disintegration constant, and the type of rays emitted by each are described in a table. Two classic methods of measuring radioactivity in the atmosphere are discussed: the direct or emanometry method, and the indirect or induction method. The latter is simpler but less reliable except when dealing with certain elements whose life is too short for emanometer techniques. Corrections for time, saturation deficit, pressure and temperature are discussed. Actual measurements of radon content of the atmosphere in various parts of the earth (1907–1942) according to different authorities, are tabulated. Relation to meteorological conditions (pressure, wind, air mass, precipitation, austausch, etc.), vertical and geographical distribution are then treated. Finally, unsolved problems such as the development of automatic recording devices to substitute for isolated measurements, surveys by networks to determine simultaneous geographical (horizontal and cross section) distribution, development of an air mass classification based on radioactive elements in air, determination of radioactivity of precipitation and relation to thunderstorm activity and survey classification and analysis of records of radioactivity in atmosphere and in precipitation are reviewed. *Subject Headings:* **1. Radioactivity in the atmosphere 2. Ionization 3. Austausch 4. Emanometry 5. Compendium articles.**—*M.R.*

4.2–12 551.510.42(02)

Meetham, Alfred Roger, **Atmospheric pollution: its origin and prevention.** London, Pergamon Press, **1952.** 268 p. 81 figs., 27 tables, refs. **GB-MO**—This book is of general interest. It presents information on measurement, distribution and effects of atmospheric pollution by smoke, gases and offensive particles, fuels, fuel-burning appliances, industrial processes and domestic fires. Then follows a study of the properties of atmospheric pollution under the headings: smoke, ash, sulphur dioxide, etc., and the various methods of measuring each of these components. The distribution of atmospheric pollution and of its components is discussed and mapped for Britain as a whole and for typical towns, open spaces, etc. The yearly, weekly and daily cycles are summarized, including irregular variations due to weather. Effects of pollution on health, corrosion, light, etc. are briefly examined. The total loss in Britain is estimated as 100 million pounds a year. Finally, methods of preventing or minimizing pollution are discussed and the laws against pollution set out. *Subject Headings:* **1. Atmospheric pollution 2. Smoke 3. England.**—*C.E.P.B.*

4.2–13 551.515.2:551.513.1

Riehl, Herbert (*Univ. of Chicago*), **Aerology of tropical storms.** (In: **Compendium of Meteorology.** Boston, American Meteorological Society, **1951.** p. 902–913. 6 figs., 44 refs.) **MH-BH**—A comprehensive review of the current knowledge on the structure, formation and movement of tropical storms is presented. For improving observational data the author suggests observations of cumulus clouds, estimates of altitude and motion of middle and high clouds and installation of nephoscopes, and use of rawin instead of pilot balloons. With respect to methods of analysis the author proposes the extension of tropical analysis to high levels and high latitudes; the use of contour and streamline analysis and the preparation of stability charts and of charts showing the base of the westerlies. The discussion of the structure of tropical storms during the motive stage includes the following topics: the thermal structure of the rain area; the microstructure of the rain areas in particular, pressure fluctuations and cloud conditions; the thermal structure of the eye; the dynamical structure of the storm involving heat transfer, wind distribution near the surface and upper outflow; the dynamical characteristics of the eye; and the maintenance of tropical storms. The various theories of hurricane formation, namely: the convection and frontal theories and the hypotheses of . S. Sawyer and of H. Riehl are presented. The role of the steering principle on the movement of tropical storms, the forecasting of recurvature and of the motion of large storms are considered. *Subject Headings:* **1. Cyclonic storms 2. Atmospheric circulation 3. Tropical meteorology 4. Tropical storms 5. Compendium articles.**—*I.L.D.*

4.2–14 551.543

*Schumann, Theodor E. W. and Van Rooy, M. P., **Ontleding van du standaardafwyking van Lugdruk oor du Noordelike Halfrond.** [Analysis of the standard deviation of atmospheric pressure over the Northern Hemisphere.] *South Africa. Weather Bureau, W. B.*, No. 16, **1951.** 21+p. tables, charts, refs. In English and Afrikaans. Price: 5/–. **DWB**—A great deal of statistical tabulation and analysis has gone into this publication, which is a sort of sequel to the study of continentality and atmospheric pressure variations which the authors published in 1950. In this study the standard deviation of daily pressure ($u$) rather than the mean pressure is analyzed and shown in tables and charts. Values were computed for coordinates throughout the hemisphere based on data for 1929–1938 furnished by the U. S. Weather Bureau. Isolines of $u$ are drawn for each season, showing the effect of the Aleutian and Icelandic Lows in the fall, winter and spring, and the weak polar Low in summer. The standard deviation ($v$) of mean monthly pressure is similarly computed, but for 1900–1938. Relation between $u$ and $v$ is also analyzed, and found to be very close. It is stated that the deviations are greater on the oceans than the continents, and on the west coasts than the east coasts of the continents, due to the damping effect of friction over the continents on the large scale turbulence which is responsible for fluctuations in pressure from day to day or month to month. However, a close examination of the charts shows that this is true only over the continent of Eurasia, and to some extent in the Arctic regions of America. The region of North America below 55°N latitude shows as great or greater deviations on the east coast as on the west coast, the east coast being subject to maritime influences as far inland as

the west coast. In the tropical regions a difference between continent and ocean is not evident on the chart. The deviations in the three major centers of high values (Aleutians, Iceland and the Barents-Kara Sea) are not appreciably different in magnitude, except in the last named area which shows consistently lower standard deviations. *Subject Headings:* **1. Interdiurnal pressure variations 2. Climatic atlases 3. Northern Hemisphere.**—*M.R.*

4.2–15 551.5(02) 551.511

†Sutton, O. G. (*Military Col. of Science, Shrivenham, Eng.*), **Micrometeorology: a study of physical processes in the lowest layers of the earth's atmosphere.** New York, McGraw-Hill, **1953.** 333 p. 35 figs., 30 tables, 232 refs., eqs.—Without doubt this is the most important meteorological publication of the year. The book attempts to give a thorough and systematic treatment of the physics of the surface or ground layer of the atmosphere, and as such it is the first book of its kind—on a par with GEIGER's famous book on "Microclimatology." The organization of the text is simple: starting with the physics of the atmosphere at rest, then taking up respectively: laminar flow, turbulent flow, heat transfer and diffusion, radiation (short and long wave), temperature, wind structure, diffusion and evaporation. The history of each subject is outlined and the treatment logical from the general to the theories and then particular aspects and applications (including a detailed bibliography at the end of each chapter). The approach is naturally mathematical but not difficult, and the practical use (e.g. forecasting night minimum temperatures and frost, or problems of diffusion of water vapor or stack gases) constantly kept in view and elaborated on as far as is possible in a book intended to give general background and inspiration rather than information such as a handbook or manual would give. The concept of atmospheric processes being mainly turbulent and thus best studied by statistical methods is gaining considerable ground in the last few years, so we should be thankful someone as competent as O. G. SUTTON has at last given us a guide to the study of the lower troposphere from that point of view. A good author and subject index adds much to the usefulness of the book. *Subject Headings:* **1. Micrometeorology 2. Physics of the atmosphere 3. Textbooks 4. Bibliographies.**—*M.R.*

## GENERAL METEOROLOGY

*See also item:* **4.2–43,** Meteorological information from ships (Frankcom)

4.2–16 551.5(02) 551.511

Steinhauser, Ferdinand (*Vienna*), **Geschichte und Tätigkeit des Sonnblickvereins und seiner Observatorien von 1939 bis 1950.** [History and activities of the Sonnblickverein and its observatories from 1939 to 1950.] *Sonnblick-Verein, Vienna, Jahresbericht,* 48:33–36 **1950. DWB**—War-time and post-war difficulties of the Sonnblick Society are outlined. In 1938 six of the society's nine observatories were taken over by the German Weather Service. During the war all observatories were turned over to military authorities. All records from the Sonnblick and Obir observatories were transferred to Vienna and were saved, thus escaping the fate of the rest of Austrian observation material prior to 1936, which was completely destroyed in a fire. After the war the society could barely subsist from funds raised by the Austrian Academy of Sciences, various collections, etc. Regular observation on the Sonnblick was resumed in 1947. *Subject Headings:* **1. Sonnblick Society 2. Mountain observatories 3. Austria.**—*G.T.*

4.2–17 551.5:06(438)

Zych, Stanisław, **Konferencja Światowej Organizacji Meteorologicznej w Paryżu.** [Conference of the World Meteorological Organization in Paris.] *Przegląd Meteorologiczny i Hydrologiczny,* Warsaw, v. 1950/1951:252–256, **1951. DWB**—Report of the conference held in Paris in 1951, with a list of the elected officers. Reasons for organizing the W.M.O. and its aims. *Subject Headings:* **1. World Meteorological Organization 2. Conferences 3. Poland.**—*Wanda Tomcyzkowski*

4.2–18 551.5:061.3(43)

Gressel, W. (*Vienna*), **Bericht über die Tagung der Deutschen Meteorologischen Gesellschaft, Bad Kissingen vom 12.–15.X.1951.** [Report on the meeting of the Deutsche Meteorologische Gesellschaft, Bad Kissingen, Oct. 12–15, 1951.] *Wetter und Leben*, Vienna, 4(1/2):25–28, Feb. **1952. DWB**—About 350 meteorologists from various parts of Europe participated in this conference. The reports and discussion were related to the problems of weather forecasting, to statistical methods in prognostic work and to the dynamics of the atmosphere. Also under consideration were the föhn problem, investigation of atmospheric electricity in upper atmosphere, bioclimatology, local climate and the study of aerosols. *Subject Headings:* **1. Meteorological conferences 2. German Meteorological Society 3. Germany.**—*N.T.Z.*

4.2–19 551.5:061.6:37

**The Department of Meteorology and Climatology, University of Washington.** *American Meteorological Society, Bulletin*, 33(1):33–34, Jan. **1952.** 2 figs. **MH-BH**—Courses offered by the department, names of staff members, number of students, space and equipment available and research carried on are briefly outlined. Present courses lead to B.S. and M.S. degrees, but a program leading to a Ph.D. degree is being considered. Research work is mainly centered around problems connected with the lowest 50m of the atmosphere and the upper 15m of the soil. Some of the department's equipment is shown on 2 photos. *Subject Headings:* **1. Meteorological institutions 2. Teaching of meteorology 3. Meteorological research 4. Washington. University. Dept. of Meteorology and Climatology.**—*G.T.*

4.2–20 551.5:523.43

Flohn, Hermann, **Neues zur Meteorologie des Mars.** [New data on meteorology of Mars.] *Naturwissenschaftliche Rundschau*, Stuttgart, 4(1):26, Jan. **1951. DWB**—Review of S. L. Hess's article in *Journal of Met.*, p. 1–13, Jan. 1951 (*see item* 5–9 in May 1950, *MAB*). Mentioned are Hess's findings on pressure, on division of the atmosphere into troposphere and stratosphere and particularly on horizontal distribution of temperature and wind regime. *Subject Headings:* **1. Planetary atmospheres 2. Mars 3. Reviews.**—*C.K.*

4.2–21 551.5:551.311.2:69

Haynes, Benarthur Castle (*U. S. Weather Bur.*), **Fundamentals of atmospheric elements.** *American Society for Testing Materials, Philadelphia, Preprint*, No. 115, **1952.** 22 p. 16 figs., 6 tables, 2 refs. **DWB**—As a contribution to a symposium on conditioning and weathering, the importance of the use of weather records in developing criteria for the design of structures is stressed. Physical properties and statistical aspects of various weather factors, such as solar radiation, air temperature, humidity, precipitation and wind are explained and instruments used in measuring them described and illustrated. Sample records of meteorological data are presented. Attention is called to the necessity of micrometeorological measurements to supplement general records. *Subject Headings:* **1. Building construction 2. Weather effects 3. Weathering of materials 4. Meteorological instruments.**—*G.T.*

4.2–22 551.5:551.46:06

**A. H. Glenn and Associates,** *American Meteorological Society, Bulletin*, 33(1):32, Jan. **1952.** bibliog. **MH-BH**—Note on activities of the New Orleans firm which was established in 1948 to offer consulting services in meteorology and oceanography, mainly to natural resources extraction industries on the Louisiana and Texas coasts, Mexico and Venezuela. A list of 17 publications of the firm is attached. *Subject Headings:* **1. Meteorological consultants 2. Oceanographic consultants 3. New Orleans, Louisiana.**—*G.T.*

4.2–23 551.5:629.132.5

Brabazon, John Theodore Cuthbert, **Landing and taking-off of aircraft in bad weather.** London, H. M. Stationery Office, **1951.** 20 p. **DWB**—The concept of "weather minima" as applicable to landing and take-off at airports, or to "closing" of airports for landing or take-off, is discussed. The rules adopted by the ICAO are stated and the responsibility of authorities (government, operator and pilot) that are involved in decisions regarding minima,

outlined. The terms in which minima should be stated are discussed: runway visibility vs. runway visual range and a new system recommended for landing, namely critical height, critical height visibility and runway visual range to take into consideration varying methods of approach. For take-off the terms should be: running visual range and ceiling. Policies of seven other countries are outlined. *Subject Headings:* **1. Weather minima 2. Aerial navigation 3. Aeronautical meteorology 4. Visibility 5. British Isles. I. ICAO.**—*M.R.*

4.2–24 551.5:7

Rawlins, F. I. G. and Werner, A. E. A., **Scientific method and the art gallery.** *Science Progress*, London, 40(160):585–603, Oct. **1952.** 3 figs., 6 photos. **DWB**—Description of researches at the British National Gallery. Includes examination of expansion of wood, canvas, etc. with varying temperature and humidity, and methods of limiting it, use of special radiations, tintometers, etc. *Subject Headings:* **1. Applied meteorology 2. Art.**—*C.E.P.B.*

4.2–25 551.5:91(08)

†Taylor, Thomas Griffith (*ed.*), **Geography in the twentieth century; a study of growth, fields, techniques, aims and trends. . . .** New York Philosophical Library, c**1951.** 630 p. illus., bibliog. **DWB**—Chapter VIII (p. 178–195) by F. K. Hare takes up Geographical aspects of meteorology, and Chapter IX (p. 196–220), Climatic influences, by Stephen S. Visher. Chapter XXVI (p. 609–622) consists of a glossary of geographical terms by Griffith Taylor. A number of meteorological terms are briefly defined. *Subject Headings:* **1. Progress in geography 2. Climatic influences 3. Glossaries 4. Geographical terminology. I. Hare, F. K. II. Visher, Stephen S.**—*M.R.*

# METEOROLOGICAL OBSERVATIONS AND INSTRUMENTS

## METHODS OF OBSERVATION

*See also items:* 4.2–57, Comparison between free rain gage and one in ground (Malsh); 4.2–66, Objective aid to local forecasting (Gringorten); 4.2–97, Theory, development of thickness patterns (McVittie); 4.2–163, Graphic method of wind representation (Okołowicz); 4.2–175, Response of balloons to wind (Perkins); 4.2–252, Indian climostatics (Chatterjee)

4.2–26 551.501:551.574.41

Hofmann, G., **Zur Methodik der Taumessung.** [On the technique of dew measurement.] *Germany. Deutscher Wetterdienst in der U. S. Zone, Berichte*, No. 38:360–364, **1952.** 13 refs., 31 eqs. **DWB**—The temperature and dew formation of a freely exposed flat horizontal dew receiver are calculated from the characteristics of the instrument. The dew measured is only independent of the heat conduction of the receiver when dew on both surfaces is measured. Remarks on methods of dew measurement are given. *Subject Heading:* **1. Dew measuring techniques.**—*C.E.P.B.*

4.2–27 551.501:06(497.1)

Kovačević, Milan, **Problematika pribiranja i korištenja podataka u meteorološkoj službi.** [Problems of collection and evaluation of data in a meteorological service.] *Yogoslavia. Hidrometeorološka Služba, Hidrometeorološki Glasnik*, 3:72–79, **1950.** In Croatian. **DWB**—Statistical principles involved in classifying, evaluating and coordinating observational and experimental data, in eliminating errors and in drawing conclusions are discussed in general terms. It is hoped that the reorganized Yugoslav Hydrometeorological Service, with a central office securing uniformity in coordinating data and regional offices providing for a smooth and decentralized administration of observation stations, will improve meteorological research and eliminate a number of sources of error. *Subject Headings:* **1. Meteorological networks 2. Data processing 3. Hydrometeorological services 4. Yugoslavia.**—*G.T.*

4.2–28 551.501:551.510.41:546.214

Pring, J. N. and Westrip, G. M., **Electrometric determination of ozone at high dilutions.** *Nature*, London, 170(4326):530–531, Sept. 27, **1952.** 2 refs. **DWB**—Describes a method of

etermining local atmospheric concentrations of ozone by a portable apparatus which measures ne E.M.F. of a system in which hydrobromic acid is oxidized with liberation of bromine. *ubject Heading:* **1. Ozone measurement techniques.**—*C.E.P.B.*

4.2–29 551.501.1:551.577:551.508.77

Germany. Deutsche Demokratische Republik. Meteorologischer Dienst, **Anleitung ür die Beobachter an den Niederschlagsmesstellen des Meteorologischen Dienstes der Deutschen Demokratischen Republik.** [Instructions for observers at precipitation measurement stations of the Meteorological Service of the German Democratic Republic.] *Germany. Deutsche Demokratische Republik. Meteorologischer Dienst, Veröffentlichung*, No. 3, **1951.** 7 p. 8 figs. **DWB**—General information on the organization and objectives of the precipitation measurement service, on the duties of observers and on reports and administrative problems is summed up in the introduction. Rain gages used in the network of the Democratic Republic are described and practical details of their installation and operation explained. Instructions for observing and reporting all kinds of precipitation, fog, wind, electrical and optical phenomena are given. Qualitative and quantitative classification of precipitation and wind is offered, including all symbols for indicating them. Sample report sheets are appended. Although this booklet is primarily a guide for observers engaged in the East German meteorological service on the rain gage station level, it may be of interest to observers in other countries and to those seeking specific terms and definitions in German of various kinds of precipitation, fog, wind or optical and electric phenomena. *Subject Headings:* **1. Instruction for observers 2. Precipitation measurement 3. Rainfall networks 4. Rain gages 5. Eastern Germany.**—*G.T.*

4.2–30 551.501.1(09)

Russ, A., **Der Einfluss der Societas Meteorologica Palatina auf unseren heutigen Beobachtungsdienst.** [The influence of the Palatine Meteorological Society on our present station network.] *Germany. Deutscher Wetterdienst in der U. S. Zone, Berichte*, No. 38:376–380, **1952.** 12 refs. **DWB**—The earliest series of observations in Germany began about 1700, but independently and without standard instruments and methods. The Palatine Society was founded in 1780 by JACOB J. HEMMER to organize a network of standard instruments, instruct observers and publish the observations in the *Ephemerides*. The instructions (remarkably detailed for the time) are summarized. The published observations extend from 1781 through 1792. HEMMER died in 1790. *Subject Headings:* **1. History of meteorology 2. Meteorological societies 3. Palatine Meteorological Society 4. Hemmer, J. J.**—*C.E.P.B.*

4.2–31 551.501.45:656.7

Guss, Hans, **Ein statistisches Kriterium zur Kennzeichnung von Flugplätzen als meteorologische Ausweichhäfen, dargestellt für sechs deutsche Flugplätze.** [A statistical criterion for indicating airfields as alternative meteorological landing grounds, set out for six German airfields.] *Germany. Deutscher Wetterdienst in der U. S. Zone, Berichte*, No. 38:311–315, **1952.** 2 figs., 4 tables, 13 equations. **DWB**—Visibility and ceiling are used as the basis of a numerical airport unsuitability index. With this a comparison of the various airports is made. *Subject Headings:* **1. Methods of computation 2. Airports 3. Germany.**—*C.E.P.B.*

4.2–32 551.501.81:551.515.8:551.577.11

Browne, Ian C., **Precipitation streaks as a cause of radar upper bands.** *Royal Meteorological Society, Quarterly Journal*, 78(338):590–595, Oct. **1952.** 2 figs., 2 tables, 3 refs., 2 plates. **DWB**—Upper bands of enhanced radar echoes were investigated with 3 cm radar at Cambridge, England. At 9000 ft above freezing level downward velocity is 20 ft/sec, decreasing with time. They are attributed to precipitation streaks in a region of vertical wind shear; calculated and observed fall velocities agree. *Subject Headings:* **1. Precipitation streaks 2. Radar precipitation echoes.**—*C.E.P.B.*

4.2–33 551.501.83

International Civil Aviation Organization, **Radio-electric storm detection (sferics).** *International Civil Aviation Organization, Montreal, Circular* 22-AN/19, Feb. **1952.** 42 p.

13 figs., map, 53 refs. **DWB**—Physical properties of lightning discharges (which have bee found to be the main source of atmospherics) and of sferics and their propagation are describe and illustrated in schematic drawings. Watson-Watt cathode-ray oscilloscope (used i Britain), Lugeon recording apparatus (used in Switzerland and France) and a uni-direction cathode-ray direction finder developed in Sweden are described and shown in photographs an diagrams. Locations of sferics installation in 11 countries are listed. Practical usefulness radioelectric storm detection is discussed briefly. Results of ICAO meetings (held at variou places between 1947 and 1950) in which requirements for information on sferics were i vestigated are summed up. The circular was issued in English, French and Spanish. *Subje Headings:* **1. Sferics 2. Radar storm detection 3. Cathode-ray oscillographs.**—*G.T.*

4.2–34 551.501.83:551.509.34:551.515.4:551.508.94(

Meinhold, Heinz, **Die Peilung atmosphärischer Störungen zum Zwecke der Wette prognose.** [The radiolocation of atmospheric disturbances from the point of view of weath forecasting.] *Germany. Deutscher Wetterdienst in der U. S. Zone, Bericht*, No. 26:3–8, 195 charts, diagr., graphs, refs. **DWB**—Two methods of location of areas of convective activit through recordings of sferics sources (usually from lightning discharges) are described an illustrated. One method is the cathode ray direction finder (radiogoniometer) due to Sir Robert A. Watson-Watt, and the second is the Lugeon "Schmalsektorpeiler." (*S* Schindlehauer and Israël, 1944, 2H–18, Aug. 1951, *MAB*.) If goniometer readings ar obtained from three stations along the coast, storms or areas of activity several hundred mile at sea can be located. Other factors which correlate with sferics activity, such as ten perature and wind at high levels, can also be forecast. *Subject Headings:* **1. Thunderstor forecasting 2. Sferics storm detection 3. Radiogoniometers 4. Western Europe. I. Watson Watt, Sir Robert A. II. Lugeon, Jean.**—*M.R.*

4.2–35 551.501.89:551.578.4

Marshall, John Stewart and Gunn, K. L. S. (*McGill Univ., Montreal*), **Measurement snow parameters by radar.** *Journal of Meteorology*, 9(5):322–327, Oct. **1952.** 3 figs., table 12 refs., 12 eqs. **MH-BH**—Back scattering by small non-spherical particles of uncertai density is assumed proportional to $|K_1|^2ZS$ where $K_1$ is dielectric factor and $Z = D_1^6(D$ = diameter) of equivalent sphere of unit density. Using Langille and Thain's simultaneou data of $Z$ (by radar) and $R$ (rate of snowfall, mm/hr) fairly good correlations were found be tween log $Z$ and log $R$ (roughly $Z = 200\ R^{1.6}$, similar to values obtained for rain). It is inferre that bright band echo is due to increased effective particle mass caused by aggregation. Th (exponential) size distribution of snow particles is comparable with that of raindrops (Mar shall and Palmer). *Subject Headings:* **1. Radar analysis of precipitation 2. Snow structur** —*C.E.P.B.*

## OBSERVATIONAL DATA

*See also items:* 4.2–2, Relation: artificial cloud modification-precipitation (Coons and Gunn); **4.2–44**, Marine meteorological and oceanographic observations, Japan; **4.2–201**, Statistical investigations of rainfall climatology, Oahu (Landsberg)

4.2–36 551.506:90

Bowen, David, **The season's difference.** *Weather*, 7(10):295–299, Oct. **1952. MH-BH**— Extracts from diaries and letters of 18th–20th century describing the weather. *Subje Heading:* **1. Historic weather records.**—*C.E.P.B.*

4.2–37 551.506:69

Gold, Ernest and Lacy, Ralph Edward, **Heating requirements of a house.** *Meteorologic Magazine*, London, 81(960):185–186, June **1952. DWB**—Discussion (*see item* 3.3–34, Marc 1952, *MAB*). *Subject Headings:* **1. Indoor climates 2. Heating and ventilating.**

4.2–38 551.506:90

*Japan. Central Meteorological Observatory, **Weather data of Hiroshima Prefectur in historical times. Hiroshima agata kishō shiryō.** *Japan. Central Meteorological Ob*

*rvatory, Tokyo, Memoirs*, 35(1):1–51, Oct. 1950. In Japanese. **DWB**—A collection of rief notes on each of 269 events recorded from the 7th through the 19th century, which were holly or partly due to meteorological factors. The work was compiled by J. Endō from Hiroshima Chihō Kishōdai (Hiroshima Regional Met. Obs.). The events reported include eavy rains, thunderstorms, floods, typhoons, drought, damage to crops, famine, epidemics nd other calamities. Two indexes giving date and event in chronological and in subject rrangement, respectively, are added. The collection is preceded by an introduction indicating he sources used, mostly history books. *Subject Headings:* **1. Historic weather records. Hiroshima. Regional Meteorological Observatory II. Endo, Jiro** (*comp.*).—*G.T.*

4.2–39 551.506:551.577.2(52)

*Nakamura, Saemon Taro, **Meteorological statistics (Part III) precipitation.** *Tohuku University, Science Reports, 5th Ser., Geophysics*, 3(2):87–96, Sept. **1951.** 6 figs., 13 tables. **DWB**—Detailed discussion of precipitation observations made at the Mucaiyama Observatory (1915–1948). Discussion of "secular changes." Useful calculations of the duration of rought and of frequency distribution and monthly anomalies are given. *Subject Headings:* **1. Precipitation data 2. Drought 3. Mucaiyama, Japan.**—*A.A.*

4.2–40 551.506.1(058)(469)

*Coimbra. Universidade. Instituto Geofísico, **Observações meteorológicas, magnéticas, sesmológicas, 1945, Parte I, Observações Meteorológicas, v. 84.** [Meteorological, magnetic nd seismological observations, 1945, Part I, Meteorological observations, v. 84.] Coimbra, ipografia da Atlântida, **1951.** 150 p. entirely tables. **DWB**—From data observed or corded during 1945 at Cumiado (Coimbra University Observatory) lat. 40°12′N, long. °33′W, alt. 140 m. Bi-hourly or hourly values of pressure, temperature, relative humidity, apor pressure, solar radiation, brightness of sun, wind direction and speed, rain, evaporation, oud amount, type and weather condition (hydrometeors) are tabulated for each day and mmarized by 5-day, monthly and annual periods. In addition the pressure, temperature nd vapor pressure, relative humidity, clouds, wind and rain are analyzed by frequency for ch wind rhumb (16 directions). *Subject Headings:* **1. Observational data 2. Annual summaries 3. Coimbra, Portugal. I. Carvalho, Anselmo Ferraz de.**—*M.R.*

4.2–41 551.506.1:551.582(44)

*France. Météorologie Nationale, **Résumé mensuel du temps en France.** [Monthly mmary of weather in France.] First issue received, Jan. **1949;** last issue received, Nov. **951.** Publication suspended July 1939–Jan. 1947. Early issues published by the Établissement Central de la Météorologie. Tables, charts. At head of title-page: La Météorologie, Supplément, Communiqué par la Météorologie Nationale. **DLC**—Besides the sual brief summary of weather and crop conditions during the month, list of stations and ation location chart for 56 synoptic (first order) stations in France, and monthly mean and ctreme temperature, total precipitation, sunshine duration, etc., daily precipitation, maximum nd minimum temperatures for a score of stations, there are six isopleth charts showing departures from normal (1901–30) temperature, sunshine, number of days with frost, and precipitation for all of France, and total precipitation and number of days with precipitation, nd number of days with high temperatures, thunderstorms, and summary of weather and op conditions. *Subject Headings:* **1. Climate of France 2. Monthly weather reports France.**—*M.R.*

4.2–42 551.506.1:551.582.2(05)(52)

***Geophysical Review,** Tokyo. First issue received No. 605, Jan. 1950. Publ. Nov. 1950. ast issue received No. 622, June **1951.** Publ. March 1952. Publ. by the Central Meteorogical Observatory of Japan. Monthly. figs., tables, charts. In Japanese. **DLC**—A ystematic monthly review (similar to the U. S. Weather Bureau's *Monthly Weather Review* pocket size and 60–70 pages per issue) covering many phases of current weather in Japan. lthough there is some variation from month to month, the usual features are: 1) a climatogical summary of surface weather data for all of Japan, with tables, statistical analysis and

charts, 2) a weather summary (storms, typhoons, highs and lows, storm tracks, etc.), 3) a aerological summary (average monthly radiosonde data for 00 h and 12 h at each of a doze stations and (two) weather ships in the Japanese region), 4) a thunderstorm summary, 5) sola radiation, 6) agricultural meteorology, 7) limnological data, 8) chemical analysis of precipit tion, 9) phenological data, 10) oceanography, 11) tidal observations, 12) earthquakes, 13) vo canic activity, 14) miscellaneous, 15) detailed climatic data, 16) earth currents, 17) atmospher electricity and 18) terrestrial magnetism and solar phenomena. There is no country on eart that supplies such a systematic review of all phases of geophysical activity, so soon aft occurrence and with so many charts, analytical tables, etc. In the earlier years (seeming over 50 years), the content of the material can be deduced from the nature of the charts an quantities involved in tables, and by analogy with the corresponding sections in the 195 issues, which contain English captions (both in the tables of content and on charts and tables Some issues contain detailed analyses of specific typhoons, floods or other outstanding event Later issues have large inserted charts showing the detailed analyses for each day of the mont in miniature, but completely legible without magnification but with the whole months dail charts on one sheet. *Subject Headings:* **1. Monthly summaries 2. Observational data 3. Cl matic data 4. Periodicals 5. Japan.**—*M.R.*

## INSTRUMENT CARRIERS

*See also item:* 4.2–175, Response of balloons to wind (Perkins)

4.2–43 551.507.2 551.5(2

Frankcom, C. E. N., **Meteorological information from ships at sea.** *Marconi Marine* London, 11(28):292–296, Jan./Feb. **1952.** 7 figs. **GB-MO**—Popular account of observatio on ships, Maritime Commission of W.M.O., and use of ships' observations in forecasting an climatology. *Subject Headings:* **1. Marine meteorology 2. Weather ships.**—*C.E.P.B.*

4.2–44 551.507.2:551.506.3:551.465(26

*Japan. Central Meteorological Observatory, Tokyo, **The results of marine meteor logical and oceanographic observations.** No. 3–4, Jan./June, July/Dec., **1948;** March an June **1951.** photos, maps, tables. **MH-BH**—Meteorological observations were made durin 1947 and 1948 on board several vessels off Japan. For specific days during each mont hourly values of dry bulb and wet bulb temperatures, vapor pressure, relative humidity wind speed and direction, cloudiness, wind wave direction, swell, water surface temperatu and visibility are given. *Subject Headings:* **1. Marine meteorological data 2. Oceanograph observations 3. Western Pacific 4. Japan.**—*I.L.D.*

4.2–45 551.507.2(26

**Weather ships.** *Aeroplane*, London, 92(2134):735, June 13, **1952. DWB**—A ten porary agreement to maintain the present 25 Atlantic weather ships, signed by representative of 11 countries at Montreal, Canada, on May 19, 1952, is announced in a brief note which als gives a few details on the two weather stations maintained by Great Britain. *Subject Hea ings:* **1. Weather ships 2. Atlantic Ocean.**—*G.T.*

4.2–46 551.507.321.

Poje, D., **Cedulje identiteta pilot-balona.** [On the recovery of pilot balloons.] *Yug slavia. Hidrometeorološka Služba, Hidrometeorološki Glasnik*, 3:95–96, **1950.** fig. In Cro tian. **DWB**—Soundings of wind at Zagreb-Gric observatory were started in June 194 Practical problems connected with the recovery of pilot balloons are discussed. It is pointe out that in the past only 7% of the balloons sent up could be retrieved but it is hoped that th use of identification tags will increase that figure. First experiences with the tags are reporte *Subject Headings:* **1. Balloon recovery 2. Yugoslavia.**—*G.T.*

4.2–47 551.507.352:551.524.

Albrecht, Fritz, **Mikrometeorologische Temperaturmessungen von Flugzeug aus.** [M crometeorological temperature measurements from aircraft.] *Germany. Deutscher Wette*

*dienst in der U. S. Zone, Berichte*, No. 38:332–339, 1952. 3 figs., 3 tables, 3 refs. **DWB**—Records of temperature of the radiating earth's surface were made from an aircraft, using a bolometer which gave mean temperature of a spot 7–10 m across. Flights in April and May 1944 were from Baltic to 30 km inland, ending by 3 traverses of a moorland area 3 km across. The results are shown as temperature profiles at different times of day and charts of the moor, and in tables. *Subject Headings:* **1. Temperature microvariations 2. Germany.**—*C.E.P.B.*

## INSTRUMENTS

*See also items:* 4.2–5, Ozone in atmosphere (Götz); 4.2–10, Instruments and methods to measure atmospheric electricity (Israël); 4.2–29, Instruction for precipitation measurement (German Democratic Republic); 4.2–34, Radiolocation of atmospheric disturbances for weather forecasting (Meinhold); 4.2–81, Methods of measuring ozone near ground, applications (Heigel); 4.2–84, Correlation Cl particles and synoptic situation (Crozier); 4.2–89, Micromethods to determine injurious substances in air (Polezhaev, Girina and Laktionova); 4.2–179, Maximum water need of plants and its examination by evaporimeters and discharge measurements (Haude); 4.2–180, Micrometeorology of surface layer of atmosphere (Mather); 4.2–217, Agricultural hydrology, evaluated by monolith lysimeters (Harrold and Dreibelbis)

4.2–48 551.508:6

Klingenberg, L. G. and Elliott, H. H., **Instrument standardization.** *Instruments*, Pittsburgh, 25(4):454–455, 496–497, April 1952. **MH-BH**—American technology has reached an extremely high level in the production of industrial instruments, but has proceeded in the last 20 years without the standardization of the different types with the result that now the instrument user faces many obstacles and delays when engineering the instrumentation for a plant. The author discusses only the problems associated with industrial instruments used for measuring and control processes—variables such as pressure, temperature, flow and level. However, he assumes that the standardization program should cover all types of instruments, including inspection of the relation of the sizes of the instruments, their preciseness, sensitivity, etc. *Subject Headings:* **1. Instrument standardization 2. Industrial meteorology.**—*N.T.Z.*

4.2–49 551.508:681:620.1

Moss, E. B., **Development of materials for instrument manufacture.** *Society of Instrument Technology, Transactions*, London, 3(4):143–156, Dec. 1951. 8 figs., 2 tables. **GB-MO**—Various materials developed in past 25 years, suitable for instrument components, are described and their properties tabulated. Sec. 5 is "Materials for the temperature compensation of electrical and magnetic instruments." *Subject Heading:* **1. Instruments.**—*C.E.P.B.*

4.2–50 551.508.21:551.521.13

Georgi, Johannes (*Hamburg*), **Das neue Absolut-Pyrheliometer von Prof. K. Wegener.** [The new absolute pyrheliometer of Prof. K. Wegener.] Wegener, Kurt (*Buenos Aires*), **Erwiderung zu dem Aufsatz von Dr. Georgi: Das neue Absolut-Pyrheliometer von Prof. K. Wegener.** [Reply to Dr. Georgi's article: The new absolute pyrheliometer of Prof. K. Wegener.] *Geofisica Pura e Applicata*, 20:77–85, July–Dec. 1951. Reply by Georgi, J. p. 86. fig., table, 8 refs., eqs. In German, German and English summaries p. 77. **MH-BH**—The author was not aware of the latest work of Prof. K. Wegener but went ahead and discussed the theory proposed by Wegener in his earlier work (*see item* 2.7–36 and 2.7–38, July 1951, *MAB*) criticizing the Smithsonian solar constant and methods of determination thereof. He shows that the error involved is only .5% and not of the order of 25% as Wegener first declared. Wegener's improved instrument is described and illustrated, and the theory and accuracy treated at length. *Subject Headings:* **1. Actinometers 2. Smithsonian Solar Constant. I. Wegener, Kurt Friedrich.**—*M.R.*

4.2–51 551.508.21

Kojima, Shoji and Yamamoto, Nobuo, **A bolometer with negative feed back.** *Tokyo. Univ. of Education. Institute for Optical Research, Science of Light*, 1(1):49–50, Jan. 1951. 6 figs. In Japanese, English summary, append. p. 4. **DWB**—As a bolometer stabilizer a

negative feed back circuit is used. It has been improved with respect to the following two points: 1) to give large time constant by the use of a heat capacity and 2) to avoid the transition to positive feed back at the large unbalance of the bridge by employing in-phase detection. A block diagram is shown. *Subject Heading:* **1. Bolometers.**—*Author's abstract.*

4.2–52 551.508.21

Yamashita, Tairi, **Dielectric bolometer.** *Tokyo. Univ. of Education, Institute for Optical Research, Science of Light,* 1(1):51–57, Jan. **1951.** 9 figs., 2 tables. In Japanese, English summary append. p. 5. **DWB**—Dielectrics have been often used for bolometer elements on account of the high temperature coefficient of their impedance. The author discussed the bolometer circuits and constructed some dielectric bolometers and found that the sensitivity of the bolometers made of parchment paper was about 35 volt watt$^{-1}$ cm$^{-2}$. *Subject Heading:* **1. Dielectric bolometers.**—*Author's abstract.*

4.2–53 551.508.74

Gelbke, W., **Untersuchungen zur Entwicklung elektrischer Tauregistrierverfahren.** [Investigations for the development of electrical dew-recording methods.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte,* No. 35:306–311, **1952.** 4 figs. **MH-BH**—Dew measurements are falsified by "dew shadows," evaporation, corrosion etc. Two new models of a self-emptying dew recorder are described. *Subject Heading:* **1. Drosometers.**—*C.E.P.B.*

4.2–54 551.508.765 551.575

Brun, E., Demon, L., Vasseur, M. and Caron, R., **Quelques travaux sur les brouillards effectués au laboratoire de physique atmosphérique de l'O.N.E.R.A.** [Some works on fog carried out in the laboratory of atmospheric physics of O.N.E.R.A.] *La Météorologie,* 4th Ser., No. 9:82–83, Jan.–March **1948. DWB**—Includes summaries of two papers at the Société Météorologique de France, April 15, 1947: 1) Mechanical capture of corpuscles suspended in the air; 2) A new apparatus for measuring the mass of liquid water in unit volume of fog; and also a note by L. Demon: "Détecteur ionique de brouillard." [Ionic fog detector.] *Subject Headings:* **1. Fog 2. Fog detectors.**—*C.E.P.B.*

4.2–55 551.508.765:551.574.1

Golitzine, N. (*Ottawa*), **Method for measuring the size of water droplets in clouds, fogs, and sprays.** *National Research Council of Canada, Report* No. ME-177, March 22, **1950.** 13 p.+22 photos. tables, refs. **DWB**—Photomicrographs of water drops ranging in size from 5 to 250$\mu$ are made from samples obtained on oil covered slides. Equipment, frequency data and many examples of photomicrographs appear in illustrations. Four methods of collection are described and their advantages and disadvantages cited. The one used is simplest and most effective; can be used for either fog, cloud or rain sampling. Time of exposure is critical for good results. Method of measurement described in detail. Prints are magnified about 100 times, at least 300 are measured from each sample and the median diameter determined. *Subject Headings:* **1. Drop size distribution measurement 2. Photomicrographs 3. Cloud physics. I. National Research Council of Canada.**—*M.R.*

4.2–56 551.508.769

Bitron, M., **Optical methods for measuring particle size in aerosols.** (In: Israel. Rainfall Research Committee, **Symposium on artificial rain.** Hakirya, Aug. **1951.** p. 30–39. 6 figs., eqs. In Hebrew, English summary p. 10–12.) **DWB**—Particles with radius >1 micron can be measured by sedimentation, centrifugation, and direct observation. For particles smaller than this size optical methods based upon scattering of light have been developed. The electromagnetic theory of the scattering of light of particles in aerosols, the Mie and Rayleigh equation for measuring particle size, various methods of measuring particle size in accordance with the Mie theory and the contribution of La Mer are discussed. *Subject Heading:* **1. Aerosol measurement.**—*I.L.D.*

4.2–57 551.508.77:551.501.9

Malsch, Wolfgang, **Vergleich von Niederschlagsmessungen mit einem freistehenden und einem in die Erde versenkten Regenmesser.** [Comparison of rainfall measurements with a

free rain gage and one sunk in the ground.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 35:316–320, **1952.** 3 tables. **MH-BH**—Readings of 2 rain gages in open situation at Karlsruhe, one 1 m and the other 5 cm above the ground, are compared. The latter averaged 1.5% more, differences were very irregular. *Subject Headings:* **1. Rain gage exposure 2. Rain gage comparisons.**—*C.E.P.B.*

4.2–58 551.508.77

Rogers, Robert, **A new recording gauge.** *The Kentucky Engineer*, Lexington, Ky., 14(2):19–23, Feb. **1952.** 4 figs. **DLC**—A recording rain gage with six-inch diameter catch, developed by K. O. LANGE (Physics Dept., Univ. of Kentucky), is described in detail and shown in photos and a diagram. The instrument was constructed in response to the urgent need for a simple and inexpensive, yet accurate, gage for use in establishing reliable networks which could substantiate claims of artificial precipitation. Data obtained with the new gage are compared with simultaneous records of conventional 8-in. gages and found to be satisfactory. *Subject Headings:* **1. Rain gages 2. Recording equipment 3. Instrument comparisons. I. Lange, K. O.**—*G.T.*

4.2–59 551.508.77:519.25(777)

Thom, Herbert C. S. (*U. S. Weather Bureau*), **A report on the estimation of sampling errors in raingage networks.** [June **1945**]. 14 p. 4 tables, ref., 18 eqs. Typescript. **DWB**—Because results obtained by uniform sampling from data in the dense network of the Muskingum Valley, Ohio were unsatisfactory, "it was decided to develop a rather general statistical model of the raingage network sampling problem." Monthly rainfall data (1910–1940) from the Central Crop reporting district of Iowa were used "for estimating parameters and to obtain a working example of estimating sample errors." Correlation coefficients to show variations with distance were computed from Muskingum Valley data, and data from both states were studied to examine local biases. *Subject Headings:* **1. Rain gage networks 2. Sampling errors 3. Correlation coefficients 4. Iowa. I. Iowa. State College of Agriculture and Mechanic Arts.**—*M.P.K.*

## SYNOPTIC ANALYSIS AND FORECASTING

*See also item:* **4.2–34,** Radiolocation of atmospheric disturbances for weather forecasting (Meinhold)

4.2–60 551.509.34:551.521.2:551.524.36

Saunders, W. E., **Some further aspects of night cooling under clear skies.** *Royal Meteorological Society, Quarterly Journal*, 78(338):603–612, Oct. **1952.** 6 figs., 3 tables, 7 refs. **DWB**—A marked slowing down around 20 h of rate of fall of temperature in the lowest few feet, important in forecasting time of fog formation, is studied. It is associated with dew formation. Regression equations are given for forecasting temperature at time of change, with and without inversion below 900 mb. The progress of subsequent cooling is discussed and application to forecasting explained. *Subject Headings:* **1. Radiational cooling 2. Nocturnal cooling 3. Local forecasting.**—*C.E.P.B.*

4.2–61 551.509.39:551.577.32(54)

Bhullar, G. S. (*Regional Met. Center, N. Delhi*), **Onset of monsoon over Delhi.** *Indian Journal of Meteorology and Geophysics*, 3(1):25–30, Jan. **1952.** 6 figs., 4 tables. **DWB**—A study of the onset of monsoon over Delhi and neighbourhood extending for a period of fifty years is attempted in this paper. Widespread rain over the districts around the station has been chosen as the criterion for fixing the date of onset of the monsoon. The rainfall data of the provincial raingauge stations have been examined. From the examination of the data of the past 50 years, the mean date of onset of monsoon over Delhi has been found and the standard deviation worked out. The frequency diagram shows approximately normal distribution about the mean date. Synoptic situations on these dates have also been examined and the onsets are roughly classified under different synoptic situations that brought in the

monsoon during the last 50 years. *Subject Headings:* **1. Monsoon date forecasting 2. Monsoon rains 3. Delhi, India.**—*Author's abstract.*

4.2–62 551.509.39:551.579.2(52)

Daidoji, S. and Suzuki, T., **An investigation on flood forecast in snow melting period in Hokuriku District.** *Journal of Meteorological Research*, Tokyo, 2(12):374–379, Dec. **1950.** 8 figs. 6 tables. In Japanese, English summary p. (12). **DWB**—A study of the daily amount of precipitation, snow cover and water discharge in the Kurobe, Joganji, and Jintsu Rivers during the interval Oct. 1948–Sept. 1949. *Subject Headings:* **1. Flood forecasting 2. Snow melt 3. Snow cover effects 4. Precipitation 5. Japan.**—*From authors' abstract.*

4.2–63 551.509.5:63

Baumann, Hans (*Humbolt-Univ., Berlin*), **Normen zur Erfassung des Witterungsablaufes im landwirtschaftlichen Versuchswesen und Erfassung der Beziehung zwischen Witterungsverlauf und Ernteertrag.** [Norms for recording the meteorological conditions in experimental agriculture and for the representation of the relationships between weather and yield.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 32:95–97, **1952.** table. **DWB**—The author worked out norms for recording of meteorological conditions influencing the yield. A very short account without details and adequate explanations is given. An example, showing that not only the total precipitation amount, but rather that the precipitation distribution during the growing period influences yield, is presented. Copies of the norms are available from the author. *Subject Headings:* **1. Agricultural meteorology 2. Crop yield forecasting.**—*A.A.*

4.2–64 551.509.5:551.579:519.241.1(02)

*Bogárdi, János, **Korrelációszámítás és alkamazása a hidrológiában.** [Correlation calculation and its application to hydrology.] Budapest, Akadémiai Kiadó, **1952.** 254 p. tables (many fold.), figs., equations, refs. Price 50. fr. **DWB**—A complete textbook with statistical theory necessary for hydrological forecasting studies and numerous applications of double and multiple correlation techniques to forecasting short period or seasonal runoff. The detailed contingency tables, regression curves and scatter diagrams and statistical analysis for several periods on the Danube are presented. *Subject Headings:* **1. Statistical techniques 2. Hydrologic forecasting 3. Textbooks 4. Hungarian language 5. Danube.**—*M.R.*

4.2–65 551.509.5:551.515.3

§Carr, J. A., **A preliminary report on the tornadoes of March 21–22, 1952.** *Monthly Weather Review*, 80(3):50–58, March **1952.** 22 figs., refs. **DWB**—Surface synoptic chart shows relation of areas of thunderstorm, tornadoes and precipitation to air masses and fronts. Composite charts show 3-hourly frontal movements March 19–22, 1952. Upper and adiabatic level charts show vertical structure on Mar. 21 and 22 in vicinity of tornadoes. Instability charts (potential and Showalter types), show correspondence of high instability with areas of tornado occurrence. A barograph trace for Dyersberg, Tenn. illustrates drop in pressure when tornado passed 41 yds from station. *Subject Headings:* **1. Tornado forecasting 2. Mississippi Basin.**—*M.R.*

4.2–66 551.509.5:551.509.312:551.501.45

Gringorten, Irving I. (*Cambridge, Mass.*), **An objective aid to local forecasting.** *American Meteorological Society, Bulletin*, 33(5):202–207, May **1952.** 2 figs., 5 tables, 3 refs. **MH-BH**—The author discusses some of the research to increase the objectivity in forecasting carried out in "in house" projects at Geophysical Research Directorate. The application of numerical calculation and the development of statistical guides which are basically climatic summaries are described and evaluated. The author suggests the use of a "register" of the weather over a long period (10 years) as the basic part of the forecast guide. Its "purpose would be to present to the forecaster a handful of previous meteorological cases that would be similar to the present case, and could serve as a starting point in formulating forecasts" for various operational requirements. An example of such a register for the Mitchel Air Force Base, N. Y., is shown

id its use in a specific forecast is illustrated. *Subject Headings:* **1. Objective forecasting . Mathematical forecasting 3. Statistics in meteorology.**—*I.L.D.*

## CLOUD SEEDING AND ARTIFICIAL PRECIPITATION

4.2–67 551.509.67:519.24(791)

Brier, Glenn W. and Enger, Isadore (*U. S. Weather Bureau, Wash., D. C.*), **An analysis f the results of the 1951 cloud seeding operations in central Arizona.** *American Meteoro-ogical Society, Bulletin*, 33(5):208–210, May **1952.** 2 figs., 2 tables. **MH-BH**—An in- ependent statistical analysis of the experiment of P. H. MacCready, Jr. on cloud seeding in entrai Arizona during 1951. A more complete network of stations, more past data and slightly ifferent statistical techniques were used. On the basis of a 31-year record, precipitation in he seeded area in 1951 was larger than normal; however the departure from the regression ime was not significant, the t-test indicating 18 chances out of a 100 of obtaining a positive eparture of this magnitude from the regression line. Adding more stations with at least 10 ears of record gave a highly significant departure ($P < 0.01$) for the 1951 value. Using only he last 10 years of data gave a probability of 0.08 (compared with 0.18 with 31-year record). he "significance of the result depends on both the network of stations and the length of ecord available." *Subject Headings:* **1. Cloud seeding 2. Artificial precipitation 3. Sta- istical techniques 4. Arizona. I. MacCready, P. H., Jr.**—*I.L.D.*

4.2–68 551.509.67

**Can we make it rain?** *Farm Quarterly*, Cincinnati, 7(2):34–37, 127–131, Summer **1952.** hotos. **DWB**—Popular discussion of the controversial topic of rain making. Experiments nade with dry ice and AgI at the General Electric Res. Lab., Schenectady, N. Y. and various ommercial cloud seeding enterprises in the West, in California, in Massachusetts, New York, uba and Peru are described. Photographs of falling water droplets, of a laboratory cloud, f a "race track" seeding pattern, of silver iodide generators in action, of members of Project irrus and of Dr. F. W. Reichelderfer of the U. S. Weather Bureau are presented. Quotes everal statements by authorities in the field. The author concludes that although it is not et possible to produce rain exactly at the desired place and time, "there seems to be fairly omplete agreement among all the people in the weather field that given the right conditions ainfall can be increased" and the absolute control of precipitation may well become a reality within a not too distant future. *Subject Heading:* **1. Artificial precipitation.**—*G.T.*

4.2–69 551.509.67

**Cloud seeding and U. S. weather.** *South African Journal of Science*, Pretoria 48(4):137, Nov. **1951. DLC**—A definite seven-day cycle of rain and other weather phenomena last year s thought by Dr. Irving Langmuir to have resulted from the weekly cloud seeding in New Mexico which might possibly have "triggered" a periodic oscillation in pressure or other weather elements. *Subject Headings:* **1. Artificial precipitation 2. Cloud seeding 3. United States.**—*M.P.K.*

4.2–70 551.509.67

**Eine neue Methode zur künstlichen Erzeugung von Niederschlag aus Cumuluswolken.** [A new method of artificially causing rain from cumulus clouds.] *Annalen der Meteorologie*, 5(1–2):45–46, **1952. DWB**—Account of Bowen's method of spraying clouds with water. *Subject Headings:* **1. Cloud seeding 2. Artificial precipitation.**—*C.E.P.B.*

4.2–71 551.509.67:551.574.2

General Electric Research Laboratory, Schenectady, **Project Cirrus. Occasional Reports, No. 31–33.** Contract DA-36-039-sc-15345, Occasional Reports No. [2]–4, Feb. 15–March 1, **1952.** 3 pieces, diagrs., refs. **DWB**—In report 31, B. Vonnegut and K. Maynard give a detailed description of an air-borne AgI smoke generator, its installation and operation. Examples of tests made with the apparatus are included. Diagrams and photographs of the generator and its installation and cloud photographs showing the effect of seedings are pre-

sented. In reports 32 and 33 (both March 1) V. J. SCHAEFER describes and illustrates thre different cloud chambers and gives an account of experiments conducted with them and their results. The experiments were mainly concerned with the growth of ice crystals, th effect produced by dry ice and AgI seeding, the formation of condensation nuclei, microscop studies of cloud particles, formation of ice crystal clusters, the instability of air containin high concentrations of droplets and crystals and transition phenomena with benzene droplet and crystals. The effect of dry ice and AgI is shown in photographs. *Subject Heading* **1. Silver iodide smoke generators 2. Cloud seeding 3. Cloud physics research. I. Vonnegu Bernard II. Maynard, Kiah III. Schaefer, Vincent J. IV. Contract DA-36-039-sc-15345.**— *G.T.*

4.2–72 551.509.67:551.574.

General Electric Research Laboratory, Schenectady, N. Y., **Project Cirrus. Quarterl Progress Report, No. 18.** Contract DA-36-039-sc-15345, Third Quarterly Progress Report April 30, **1952.** 3 p. **DWB**—A short technical report on work done in analysis of cycli periodicities, studies of ice nuclei on Mt. Washington cloud chambers, a salt particle detector a plastic base for snow crystal replicas, storage containers for aerosol samples and observatio methods for crystalline aerosols. More detailed information will be given in later reports *Subject Headings:* **1. Artificial precipitation 2. Artificial condensation 3. Cycles. I. Contrac DA-36-039-sc-15345 II. Schaefer, Vincent J.**—*A.A.*

4.2–73 551.509.67:01

†Harris, D. Lee, **A short bibliography on artificial production of precipitation, prepared b the Scientific Services Division.** Washington, D. C., U. S. Weather Bureau, June 1, 1950 rev. Feb. 18, **1952. DWB**—List of 58 items to supplement special bibliography on clou physics and rain making (*see* p. 174–205, March 1950, *MAB*). *Subject Headings:* **1. Artificia precipitation 2. Cloud seeding 3. Bibliographies. I. U. S. Weather Bureau.**—*M.R.*

4.2–74 551.509.6

North American Weather Consultants, Pasadena, Calif., **Increasing rainfall and snowpack through cloud seeding. 1952.** 8 unnumbered pages. 12 figs. **DWB**—An attractively illustrated pamphlet giving a few of the scientific principles of natural and artificial precipitatio formation, the functions of the North American Weather Consultants Meteorological Office in Pasadena, and their operations in cloud seeding by AgI throughout the Western States. A map shows location of generators and rain gages in Southern California. *Subject Headings:* **1. Artificial precipitation 2. Silver iodide 3. Cloud seeding 4. California.**—*M.R.*

4.2–75 551.509.67(71)(94)

Orr, John L., Fraser, D. and Petit, K. G., **Analysis of experiments on inducing precipita- tion.** *National Research Council of Canada, Report,* No. MD-32. Ottawa, Aug. 17, 1949. photos., graphs, tables, refs., bibliog. **DWB**—Results of 59 Canadian attempts to produce precipitation artificially by dry ice seeding are compared with results of 20 similar trials in Australia and an excellent analysis given in tables and graphs. Beautiful photographs show the effects of seeding in several cases: 1) inducing upward convective action at cloud top; 2) producing ice crystal veil; 3) dissipation of a supercooled deck of stratocumulus; and 4) producing a horizontal cloud in hitherto clear but supersaturated air. Successes occurred most often in deep clouds, with low bases and at cloud top temperatures of −12°C or lower. (*See item* C–204, March 1950, *MAB* for abstract of condensed article by same authors.) *Sub- ject Headings:* **1. Cloud seeding 2. Dry ice 3. Canada 4. Australia. I. National Research Council of Canada.**—*M.R.*

4.2–76 551.509.67:551.509.31(94)

*Smith, E. J. (*Univ. Grounds, Sydney*), **The influence of meteorological conditions on rain- making in the Sydney area.** *Australian Journal of Scientific Research, Ser. A, Physical Sciences,* Melbourne, 5(1):87–103, March **1952.** 9 figs., 5 tables. **MH-BH**—Between Jan. 1948 and June 30, 1950, 88 flights were made within 150 miles of Sydney, Australia to stimulate

ainfall by artificial means. These flights are tabulated and classified according to synoptic tuation, height of freezing level above or below normal, water content of cloud 2000 ft > freezg level, difference in height between 0 and +10°C isotherms. These criteria are correlated ndividually with relative success of attempts (whether rain was induced, reached the ground r not), and the most important criteria thus determined. High water content 2000 ft above reezing level was a good criteria for success, but even better was a "rain-making index" made p from synthesis of various parameters. For 1948, 1949 and 1950 the number of possible ays for rainmaking was 45, 33 and 8. Synoptic situations favorable for rainmaking are lustrated. Forecasts from synoptic charts alone are better indication than when yesterday's adiosonde data are used. Improvement might occur if today's ascent were available just rior to the flight. *Subject Headings:* **1. Cloud seeding 2. Artificial precipitation 3. Sydney, ustralia.**—*M.R.*

4.2–77 551.509.67

†Weickmann, Helmut K., **Das Problem der künstlichen Vermehrung von Aufgleitniederchlägen.** [The problem of artificially increasing upglide rainfall.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte,* No. 38:401–407, **1952.** 4 figs., 4 tables, 21 refs. German nd English summaries p. 401. **DWB**—The precipitation due to a warm front upglide is nalyzed. The possible effect of increasing the number of nuclei is discussed, but it is found hat the rainfall intensity depends mainly on convergence. Nuclei are of secondary importance nd can only increase precipitation locally when the upglide is irregular. *Subject Heading:* **.. Artificial precipitation.**—*C.E.P.B.*

# STRUCTURE AND PHYSICS OF THE ATMOSPHERE

## STRUCTURE OF THE ATMOSPHERE

*See also items:* 4.2–5, Ozone in atmosphere (Götz); 4.2–9, Atmospheric pollution (Hewson); 4.2–12, Atmospheric pollution—origin, prevention (Meetham); 4.2–28, Electrometric determination of ozone at high dilution (Pring and Westrip); 4.2–136, Diffusion coefficients for volcanic dust particle, incident energy from all directions (Vittozzi); 4.2–147, Warm air inbreaks in lower stratosphere (Regener); 4.2–275, Blue sun, Sept. 1950 (Dessens); 4.2–276, Noctilucent clouds (Khvostikov); 4.2–286, Association of absorption and Es ionization with aurora at high latitudes (Heppner, Byrne and Belon)

4.2–78 551.510.41

†Bates, David R. and Witherspoon, A. E., **The photo-chemistry of some minor constituents of the earth's atmosphere ($CO_2$, CO, $CH_4$, $N_2O$).** *Royal Astronomical Society, Monthly Notices,* 112(1):101–124, **1952.** 2 figs., 2 tables, 83 refs., 61 eqs. **DWB**—Photo-dissociation of $CO_2$ is appreciable only above 100 km, where carbon occurs mainly as CO, but CO extends below this level. Combustion on earth would provide the CO content of the atmosphere in 4 years or less. Collision processes prevent appreciable $CH_2$ above 100 km and concentration is rare down to 70 km. At least 10 years and probably much longer would be required for natural production at earth's surface of existing amount. The origin of $N_2O$ is discussed; known possible reactions are very slow but may be sufficient. Diagrams show concentration of O, $O_2$ and $O_3$ up to 120 km height. An appendix discusses concentration of metastable nitrogen molecules at high levels. *Subject Headings:* **1. Atmospheric composition 2. Carbon dioxide 3. Ozone.**—*C.E.P.B.*

4.2–79 551.510.41:66

Davies, Mansel, **The principles and practice of air separation.** *Science Progress,* London, 40(159):419–435, July **1952.** 9 figs., table, refs. **DWB**—Summary of commercial methods of separating gases in the atmosphere. *Subject Heading:* **1. Atmospheric composition.**—*C.E.P.B.*

4.2–80 551.510.41:526.214

Ehmert, Alfred, **Über örtliche Einflüsse auf den Ozongehalt der Luft.** [On local influences on the ozone content of the air.] *Germany. Deutscher Wetterdienst in der US-Zone,*

*Berichte*, No. 38:283–285, **1952.** 3 figs., 4 refs. **DWB**—Ozone measurements at Weissenau on the ground and at a height of 20 m on a tower are discussed. In fine summer weather with very light winds large differences occurred, attributed to destructive effect of vegetation on ozone. Effects of thunderstorms, night ground fog and strong sunshine are also illustrated. *Subject Headings:* **1. Ozone measurements 2. Ozone in troposphere.**—*C.E.P.B.*

4.2–81 551.510.41:546.214:551.508.95

Heigel, K. (*Bad Tölz*), **Messmethoden des bodennahen Ozons und ihre Verwendung in der Praxis.** [Methods for measuring ozone near the ground and their practical applications.] *Germany. Deutscher Wetterdienst in der US-Zone, Mitteilungen*, No. 14, April 1952, 19 p. 8 figs., 2 tables, 13 refs. **DLC**—The meteorological value of a quantitative determination of ozone near the ground and the chemical basis for determining ozone by its reaction with KI and its titration with sodium theosulfate are discussed. The author thus describes the electrometric titration method of EHMERT, the "Aran" measuring apparatus of CURRY-DIRNAGLE and the ozone measuring apparatus of EFFENBERGER. The various apparatus are illustrated with diagrams. Their operations and calibration are discussed in detail and the advantages and disadvantages of the various apparatus are analyzed. *Subject Headings:* **1. Ozone measurement techniques 2. Ozonometers.**—*I.L.D.*

4.2–82 551.510.41:546.214

†Jessel, U., **Untersuchungen über die Vergleichbarkeit chemischer Ozonmessungen.** [Investigations on the comparability of chemical ozone measurements.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:285–288, **1952.** 3 tables, 22 refs. **DWB**—Great differences are found between the ozone measurements by H. CAUER and A. EHMERT. The causes are discussed; further investigation is required. *Subject Heading:* **1. Ozone measurements.**—*C.E.P.B.*

4.2–83 551.510.42

Carter, J. H. (*St. Louis*), **Some aspects of the air pollution problem. Enforcement principles and standards.** *Meteorological Monographs*, Boston, 1(4):1–3, Nov. **1951. MH-BH**—Emphasis has passed in recent years from punitive to preventive measures for reduction of smoke nuisance in cities such as St. Louis, Pittsburgh, Los Angeles, Detroit, etc. Methods of determining limits of an allowable smoke discharge for various types of fuel or boilers are explained. Chemical nature of fumes is also a criterion in determining amount of effluent allowable under given conditions. *Subject Headings:* **1. Atmospheric pollution 2. Smoke.**—*M.R.*

4.2–84 551.510.42546.13:551.508.95

Crozier, William Dwight, Seely, Ben K. and Wheeler, L. B. (*New Mex. School of Mines, Socorro, N. M.*), **Correlation of chloride particle abundance with the synoptic situation on a cross-country flight.** *American Meteorological Society, Bulletin*, 33(3):95–100, March **1952.** 3 figs., 10 refs. **MH-BH**—Airborne chloride particles were collected by airplane on a cross-country flight during August 1948. The collecting apparatus consisted of ¼ inch nozzle directing a jet of particle-containing air at a velocity of 80–90 m/sec against a collecting surface cooled with a gel of gelatin and glycerine containing a mercurous nitrate. An analysis of the meteorological solution on the days on which chloride counts were made leads to the conclusion that they originated in the Gulf of Mexico and in the Pacific off the coast of Mexico. Surface and upper synoptic charts of the days of flight and data on chloride and pollen concentration are presented graphically and numerically. *Subject Headings:* **1. Atmospheric chloride particles 2. Air sampling instruments 3. Airplane observations.**—*I.L.D.*

4.2–85 551.510.42

Ely, Sumner B. (*comp.*), **Report on stationary stacks, 1951.** Pittsburgh, Bureau of Smoke Prevention, **1952.** 15 p. tables. **DWB**—Report on the work of Bureau of Smoke Prevention, Pittsburgh. Results of U. S. Weather Bureau's "smoke observations" from 1945 to 1951 are tabulated. Dust collected during 1951 in cans and electrical precipitators is analyzed quantitatively and qualitatively. Savings due to smoke elimination and cleanliness

re estimated. Smoke inspector activities from 1948 to 1951 are specified. A considerable ecrease in smoke during the last 7 years is noted and the conclusion reached that the name Smoky City" for Pittsburgh has now become a misnomer. *Subject Headings:* **1. Atmospheric ollution 2. Smoke 3. Pittsburgh, Pennsylvania. I. Pittsburgh. Bureau of Smoke Preven- ion.**—*G.T.*

4.2–86 551.510.42:551.21

Henson, Frederick A. (*Univ. of Nottingham*), **Volcanic ash from the Hekla eruption of 947.** *Geological Magazine*, London, 89(4):293–298, July/Aug. **1952.** 2 figs. **DLC**—Ash eposited on a trawler 39 nautical miles from Hekla volcano from which it was ejected on March 29, 1947, is analyzed. Data on size distribution of particles and on chemical com- osition are presented. Weather conditions prevailing at the time of the eruption are de- cribed and their effect on trajectories of particles of various sizes discussed. A surface eather map for the day is presented. Thirty thousand feet is suggested as the initial height f all particles. *Subject Headings:* **1. Hekla eruption—1947 2. Volcanic dust.**—*G.T.*

4.2–87 551.510.42:551.574.1

Johnstone, H. Freeborn, **Properties and behavior of air contaminants.** (In: Michigan, niversity, School of Public Health, **Lectures presented at the Inservice Training Course in ir Pollution, February 6–8, 1950.** p. 17–25. 19 refs.) **DWB**—Properties and behavior f air contaminants examined. Table shows chemical composition and effects of various ollutants; analysis made of the effects of sulfur, nitrogen, halogen and other artificial and atural aerosols. *Subject Headings:* **1. Atmospheric pollution 2. Aerosols.**—*G.T.*

4.2–88 551.510.42

Los Angeles County, California. Air Pollution Control District, **Second technical and dministrative report on Air Pollution Control in Los Angeles County, 1950–1951.** Pub. by he Air Pollution Control District, [**1952**]. 51 p. 35 figs., 28 tables, refs. Review by Louis C. McCabe, in: *Industrial and Engineering Chemistry*, 44(9):125A–128A, Sept. **1952.** 3 figs., refs. **DWB**—This report includes a detailed qualitative and quantitative analysis of air ollution at Los Angeles and of its effect on functions of the human body and on the develop- ent of plants. Full accounts of the technical, administrative and financial operation of air ollution control organizations are given. Effects of wind and of temperature inversions are iscussed and data on monthly average wind speeds over Los Angeles Basin presented for the eriod 1948–1951 included. *Subject Headings:* **1. Atmospheric pollution control 2. Los ngeles County, California. I. McCabe, Louis C.**—*G.T.*

4.2–89 551.510.42:551.508.91

Polezhaev, N. G., Girina, V. V. and Laktionova, T. E., **Mikrometody opredeleniia vred- ykh veshchestv v atmosfernom vozdukhe.** [Micromethods for determining injurious ubstances in the atmosphere.] *Gigiena i Sanitariia*, 8:15–20, Aug. **1951.** 4 figs. **DLC**— description of microchemical methods for determining qualitatively the atmospheric presence f chlorine, sulfuric acid, sulfur dioxide, lead and mercury. Step by step directions for each ype of determination and diagrams of the apparatus are given. *Subject Headings:* **1. Atmos- heric pollution 2. Atmospheric pollution instruments.**—*I.L.D.*

4.2–90 551.510.42:711

Schmidt, Gerhard, **Zur Nutzbarmachung staubklimatischer Untersuchungen für die tädtebauliche Praxis.** [On the use of dust-climatic investigations for town-building prac- ice.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:201–205, **1952.** 2 figs. **DWB**—An isoline chart of Leipzig and district is compiled, showing numbers of particles per liter of air. Data are tabulated according to conditions; the observations showed apid fluctuations in places of heavy traffic, and a schematic chart is given for use in planning mprovements. *Subject Headings:* **1. Dust 2. Town planning 3. Leipzig, Germany.**— *C.E.P.B.*

4.2–91 551.510.42:0

**A second symposium on air pollution.** *Stanford Research Institute, Stanford, Calif. Research for Industry*, 4(4):1–4, May **1952.** Ports. **DWB**—Advance notice of meeting a Pasadena in May 5–6, 1952, including programs (titles of papers) and pictures of those pa ticipating. *Subject Headings:* **1. Atmospheric pollution conferences 2. Symposia. I. Nation Air Pollution Symposium, May 1952, Pasadena.**—*M.R.*

4.2–92 551.510.4

Willett, Hurd Curtis, **Meteorology as a factor in air pollution.** (In: Michigan, University School of Public Health, **Lectures presented at the Inservice Training Course in Air Pollution February 6–8, 1950.** p. 26–30.) **DWB**—The weather aspects of atmospheric pollution ar discussed in terms of specification of the weather factors involved, evaluation of the weathe factor and avoidance of extreme pollution by selection of plant sites and use of weather fore casts. Reference is made to the effect of topographic elements. *Subject Headings:* **1. Atmos pheric pollution 2. Meteorological elements.**—*G.T.*

4.2–93 551.510.42:551.575.1(794

Zarem, A. M. and Rand, W. E. (*Stanford Res. Inst.*), **Smog.** *Scientific American*, 186(5) 15–19, May **1952.** 9 figs. **DWB**—Problems arising from the existence of smog and method of investigating the composition, amount and harmful effects of smog are summed up in genera terms. Research undertaken so far by the Stanford Res. Inst. at Los Angeles and futur plans of this and other projects are discussed. Two series of photographs illustrate th formation of smog and the effect of turbulence on smog. Photomicrographs of various type of smog particles are presented. *Subject Heading:* **1. Smog.**—*G.T.*

## MECHANICS AND THERMODYNAMICS OF THE ATMOSPHERE

*See also items:* 4.2–1, Experimental cloud formation (Brunt); 4.2–15, Micrometeorology (Sutton); 4.2–105, Seasonal fluctuations of earth's rotation, general atmospheric circulation (van den Dungen, Cox and Van Miegham); 4.2–119, Model of tropical cyclone in steady state (Mantis); 4.2–140, Periodic heat transfer analysis for atmosphere with variations in eddy diffusivity (Poppendiek); 4.2–279, Diurnal atmospheric electricity variations, a meteorological-aerological phenomenon (Israël); 4B–1 to 4B–342, Bibliography on turbulent diffusion . . . Kramer, Assur and Rigby.

4.2–94 551.511:551.513.

Doporto, Mariano, **Cell motion in the atmosphere.** *Eire. Meteorological Service, Geo physical Publications*, 3(7), **1951.** 31 p. graphs, eqs., bibliog. **DWB**—Statistical investiga tions have shown that there is an isopycnic layer at 8 km with maximum pressure changes, a layer of constant pressure at about 20 km and layers with maximum horizontal motion a about 9 and 16 km. A second isopycnic layer is assumed at about 25 km. The autho applies the theory of cell waves to this case with nodal surfaces at different levels. A note worthy numerical agreement is found between the empirical results and the theory. Th interesting approach of this paper can yield important results. *Subject Headings:* **1. Cel motion 2. Isopycnic layers.**—*A.A.*

4.2–95 551.511:551.543.

Hinkelmann, Karl, **Der atmosphärische Mechanismus bei der Entstehung der täglichen Druckwelle.** [The atmospheric mechanism in the formation of the daily pressure wave.] *Meteorologische Rundschau*, 5(3/4):41–45, March/April **1952.** 3 figs., numerous equations 4 refs. **DWB**—Starting with a work by E. LINGELBACH (*see item* 3.6–77, June 1952, *MAB* author calculates the atmospheric processes set up by the diurnal course of insolation. This leads to a 24-hour pressure wave with negligible higher harmonics. *Subject Headings:* **1. Ad vection 2. Diurnal pressure variations.**—*C.E.P.B.*

4.2–96 551.511:551.543

Hinkelmann, K., **Der atmosphärische Mechanismus bei der Entstehung von Druck änderungen.** [The atmospheric mechanism in the development of pressure changes.] *Ger*

*any. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 35:100–103, **1952.** 6 refs., eqs. **WB**—Author discusses the mathematical description of 3-dimensional pressure changes by ie equations of tendency, advection and vorticity. This leads to a mechanism of pressure ndencies. *Subject Headings:* **1. Mechanics of the atmosphere 2. Pressure changes.**—*.E.P.B.*

4.2–97 551.511:551.501.7

McVittie, G. C. (*Queen Mary College, London*), **Theory of development and of thickness atterns.** *Tellus*, 4(1):8–20, Feb. **1952.** 5 refs., numerous equations. **MH-BH**—The quations of motion, of continuity, of vorticity and of heat-transfer are transformed from ordinates $(x,y,z)$ to coordinates $(x,y,p)$ without the use of the hydrostatic equation in the ertical. An approximation based on the empirical fact that the isobaric surfaces are slightly clined to the horizontal together with the use of dimensionless variables, gives the hydrostatic quation and simplifies the fundamental equations by the rejection of many of their terms. hereafter definitions of certain types of geostrophic and nongeostrophic motions lead, re- ectively, to (a) Rossby's potential-vorticity equation; (b) the development and thickness- atterns theory of R. C. SUTCLIFFE, which is discussed in detail; and (c) J. G. CHARNEY's 949) treatment of the equivalent barotropic atmosphere. These models of atmospheric otions are compared and contrasted. *Subject Headings:* **1. Dynamics of the atmosphere Equivalent barotropic theory 3. Rossby potential vorticity equation 4. Thickness patterns.** *–Author's abstract.*

4.2–98 551.511

Platzman, George W. (*Univ. of Chicago*), **The increase or decrease of mean-flow energy n large-scale horizontal flow in the atmosphere.** *Journal of Meteorology*, 9(5):347–358, ct. **1952.** 12 figs., 4 refs., 18 eqs. **MH-BH**—Author investigates the transfer of energy etween the mean flow and a disturbance in horizontal flow patterns of atmospheric type. y solving the vorticity equation the initial rate and direction of energy transfer and their time ependence are calculated for damped and amplified disturbances. This suggests that the rm and wave length of the disturbance, as well as the character of the mean flow control the itial energy transfer. "It is found that, for both initially amplified and initially damped isturbances, momentum may be transferred from both sides into a central zone of maximum ean flow." *Subject Headings:* **1. Momentum transfer 2. Stability.**—*C.E.P.B.*

4.2–99 551.511:512.9

Sherman, Leon, **A note on vector operations and coordinate systems.** *Royal Meteoro- gical Society, Quarterly Journal*, 78(338):633–634, Oct. **1952.** 2 tables, 2 refs., 4 eqs. **DWB**— iscussion of confusion in terminology of vectors and vector derivatives on a spherical earth. *ubject Headings:* **1. Vectors. 2. Terminology.**—*C.E.P.B.*

4.2–100 551.511:551.55

Sherman, Leon (*Florida St. Univ.*), **On the scalar-vorticity and horizontal-divergence quations.** *Journal of Meteorology*, 9(5):359–366, Oct. **1952.** 6 figs., 11 refs., 22 eqs. **MH-BH** —The scalar vorticity and two-dimensional divergence suffice, with boundary values, to etermine a continuous horizontal wind field, and both are synoptically important. Vorticity s a measure of intensity (cyclonic or anticyclonic) of disturbances; horizontal divergence nfluences vertical displacement and cloud formation or dissipation. The physical meanings f the terms in the scalar-vorticity and horizontal-divergence equations are discussed and these quations are rewritten with indications of the order of magnitude of the terms. *Subject Headings:* **1. Divergence 2. Vorticity theory 3. Wind fields.**—*C.E.P.B.*

4.2–101 551.511.5:551.524:551.525

Lettau, Heinz, **Synthetische Klimatologie.** [Synthetic climatology.] *Germany. Deut- cher Wetterdienst in der US-Zone, Berichte*, No. 38:127–316, **1952.** 4 figs., 3 tables, 8 refs., 50 eqs. German and English summaries p. 127. **DWB**—The differential equations of heat onduction in the upper soil and lower air, and the boundary conditions at the surface are

set out. Using eddy heat conductivity in the lower air, caloric climate is represented by theoretic daily wave involving monthly means of vertical heat transport in soil and air, so and air temperature, radiation balance and latent heat of evaporation and condensatio Calculated values in air and at different depths are given and curves of annual and diurn waves drawn. *Subject Headings:* **1. Heat balance 2. Air temperatures 3. Soil temperature 4. Physical climatology.**—*C.E.P.B.*

## GENERAL CIRCULATION

*See also items:* 4.2–13, Aerology of tropical storms (Riehl); 4.2–94, Cell motion in atmosphere (Doporto); 4.2–176, Propagation, growth of jet stream waves (Pettersen)

4.2–102 551.513.1:551.515:532.

Long, Robert R. (*Johns Hopkins Univ.*), **The flow of a liquid past a barrier in a rotatin spherical shell.** *Journal of Meteorology*, 9(3):187–199, June 1952. 18 figs., 17 refs., 8 eqs **DWB**—A model of 2 concentric rotating hemispheres was filled with water and obstacle moved relative to the resulting "zonal current." Numerous photographs of resulting flo patterns are given. When a "westerly" current flowed past a large high obstacle an "anti cyclone" formed round it followed by a train of 1–4 oscillations round the "globe," resemblin long waves. An "easterly" current produced only a wake, except that a long low obstacl (cf. Rockies) gave a series of short waves. Different obstacles and relative speeds produce different patterns; in one case a marked westerly jet appeared bounded by cyclonic vortice The theory is developed and the agreement between observations and theory examined fo individual cases. The application to the atmospheric circulation is discussed. *Subje Headings:* **1. Rotating spherical shells 2. Waves in the westerlies 3. Hydrodynamics.**— *C.E.P.B.*

4.2–103 551.513.1:551.515.

Scott, J. R., **A note on an intertropical discontinuity.** *Royal Meteorological Societ Quarterly Journal*, 78(338):621–624, Oct. 1952. ref., 4 eqs. **DWB**—Intertropical discon tinuity (ITD) is a line along which absolute vorticity is zero. Its properties, development an movement are deduced from the equations of motion. *Subject Heading:* **1. Intertropica discontinuity.**—*C.E.P.B.*

4.2–104 551.513.

Starr, Victor P. (*Mass. Inst. of Tech.*) and White, R. M. (*Cambridge Res. Center, Mass.*) **Meridional flux of angular momentum in the tropics.** *Tellus*, 4(2):118–125, May 1952 fig., table, 11 refs. **MH-BH**—The results of an attempt to measure the meridional flux o angular momentum across the vicinity of 13°N latitude from actual wind data are presented It is found that the average flux for one year is directed northward but is much smaller tha the corresponding flux at 31°N as obtained from a similar hemispheric study made earlie for that latitude. According to the data the flux at 13° is due mainly to horizontal exchang processes which are most vigorous at an elevation of about 35,000 ft. *Subject Headings* **1. Angular momentum flux 2. Meridional flux.**—*Author's abstract.*

4.2–105 551.513.1:551.511:525.

van den Dungen, F. H., Cox, J. F. and Van Mieghem, Jacques (*Univ. of Brussels*), **Le fluctuations saisonnières de la rotation du globe terrestre et la circulation atmosphériqu générale.** [Seasonal fluctuations of the earth's rotation and general atmospheric circulation. *Tellus*, 4(1):1–7, Feb. 1952. 6 figs., refs. **MH-BH**—Data obtained by N. Stoyko on th mean seasonal fluctuations in the angular rotation $\delta w/w$ of the earth at the middle and end of each month, based on quartz clock readings for 6 observatories (compared with astronomica time) over a period of 15 years, show that the rotation is accelerated in March–Aug., and retarded from Aug.–March. Study of the integrated westerly motion and resulting transfe of momentum from the atmosphere to the earth in both hemispheres shows that this, rathe than meridional flow, can account for the mean seasonal as well as anomalous changes in

*Sw/w. Subject Headings:* **1. Earth's rotation 2. Atmospheric circulation 3. Momentum transfer. I. Stoyko, N.**—*M.R.*

4.2–106 551.513.2:550.389

Flohn, Hermann, **Atmosphärische Zirkulation und erdmagnetisches Feld.** [Atmospheric circulation and geomagnetic field.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:46–51, **1952.** 3 figs., 35 refs. German and English summaries p. 46–47. **DWB**—Author finds a close resemblance between height of 200 mb surface over N. Hemisphere 1949–51 and horizontal intensity of geomagnetic field in 1950. Since kinetic energy of atmosphere is 5000 times external energy of magnetic field this parallelism is attributed to tropospheric control of ionospheric currents. *Subject Headings:* **1. Atmospheric circulation 2. Terrestrial magnetism.**—*C.E.P.B.*

4.2–107 551.513.2:551.557

Gibbs, W. J., **Notes on the mean jet-stream over Australia.** *Journal of Meteorology*, 9(4):279–284, Aug. **1952.** 9 figs., 11 refs. **DWB**—From charts of pressure surfaces for 700–100 mb levels (unpublished) cross sections of geostrophic winds normal to 130° and 150°E are drawn. Winter profiles of these at 200 mb are compared with others for S and N Hemisphere and show general agreement, with a peak of about 100 knots in 27°. In summer profiles are much weaker and less regular. Charts of mean speed at 200 mb over Australian region are drawn for July and Jan. showing some variation with longitude including a double jet stream in 150°E. *Subject Headings:* **1. Jet stream 2. Australia.**—*C.E.P.B.*

4.2–108 551.513.2:551.557

Sato, T., **Dynamics of the jet stream.** *Papers in Meteorology and Geophysics*, Tokyo, 2(2):132–149, June **1951.** 4 figs., 15 refs. **MH-BH**—The author presents a theoretical treatment of the structure of the jet stream. Under assumptions of stationary motion, uniform motion in one direction, a frictionless and autobarotropic fluid, integrals representing the law of conservation of angular momentum vorticity and energy are derived from the initial equations of motions. On the assumption of polytropy an equation determining the form of the surface of discontinuity is derived. The steepness of the surface is greater, the smaller the temp. difference and the larger the wind velocity difference between both sides of the surface. Equations are derived for determining the thickness of the mixing layer which develops at the surface as a result of the discontinuity of wind velocity. It is shown that the "jet stream is generated because there exist motions in the atmosphere conserving angular momentum and the motion cannot stretch over some extend northward owing to the surfaces of discontinuity drawn towards itself." The structure of the jet stream is described by means of diagrams and the mechanism of general circulation is discussed. *Subject Headings:* **1. Jet stream 2. Upper air winds.**—*I.L.D.*

## ATMOSPHERIC DISTURBANCES

*See also items:* **4.2–3,** Tropical cyclone (Dunn); **4.2–13,** Aerology of tropical storms (Riehl); **4.2–32,** Precipitation, cause of radar upper bands (Browne); **4.2–34,** Radiolocation of atmospheric disturbances for weather forecasting (Meinhold); **4.2–65,** Tornadoes, March 21–22, 1952 (Carr); **4.2–102,** Flow of liquid past a barrier in rotating spherical shell (Long); **4.2–103,** Interpolar discontinuity (Scott); **4.2–157,** Microbarogram peculiarities of two cold fronts (Sonntag)

4.2–109 551.515.2(729)

Fowler, W. J., **Hurricane of August 17–18, 1951, in Jamaica.** *Meteorological Magazine*, London, 81(961):197–203, July **1952.** 4 figs., 4 photos, table. **DWB**—Track of hurricane across Jamaica described with autographic records and photographs of damage. Wind 120–125 mi/hr in gusts, rainfall 17+in.; 152 lives lost. *Subject Headings:* **1. Hurricanes 2. Hurricane damage 3. Jamaica.**—*C.E.P.B.*

4.2–110 551.515.2:550.342

Kammer, Erwin W. (*Naval Res. Lab.*), **Directional properties of microseisms during hurricane "Easy" 1951.** *Journal of Meteorology*, 9(5):367–368, Oct. **1952.** 2 figs., ref. **MH-BH**—Three seismometers installed on Grand Bahama Is. recorded microseisms of period 5 sec. during passage of hurricane to E on Sept. 7–8, but microseisms travelled from 145° throughout and could not have originated in hurricane center. They are attributed to local wave action. *Subject Headings:* **1. Microseisms 2. Hurricane tracking.**—*C.E.P.B.*

4.2–111 551.515.2:551.556.1(75)

Norton, Grady (*Weather Bureau Office, Miami*), **Hurricanes of 1951.** *Monthly Weather Review*, 80(1):1–4, Jan. **1952.** fig., ref. **MH-BH**—A general summary of tropical disturbances which occurred in the Atlantic area during 1951 is given and fatalities and estimated damage caused by them indicated. It is pointed out that "this is the second consecutive year with multiple hurricanes, a rather rare occurrence in the Atlantic." Brief case histories of the 10 disturbances, 8 of them full hurricanes, are offered and their paths and times of passage plotted on a map. *Subject Headings:* **1. Hurricanes 2. Hurricane damage 3. Atlantic Coast.** —*G.T.*

4.2–112 551.515.2(9)(265)

*Philippines. Weather Bureau, **Tropical cyclones of 1949, 1950.** Manila, Weather Bureau Press, [1950–1951.] 2 pieces. chart. **DWB**—Tracks of all typhoons, history of each cyclone, maximum 24-hour rainfall wherever it occurred, maximum winds over land and sea, damage to highways and bridges, crops and human casualties, and forecasts issued by the Philippine Weather Forecasting Center are given for the 1949 and 1950 seasons, respectively, for the area from 4°–26°N and 110°–150°E, (Western Pacific). *Subject Headings:* **1. Typhoons 2. Typhoon statistics 3. Western Pacific 4. Philippines. I. Flores, Jesús F. II. Tecson, Jaime J. III. Del Rosario, Casimiro IV. Cariño, Isidro D.**—*M.R.*

4.2–113 551.515.2

**Tropical revolving storms.** *Marine Observer*, 22(157):120–122, July **1952.** fig. **DWB**—Includes descriptions and tracks of 3 West Indian hurricanes of Sept. 1951, the third of which ("Fox") produced vivid ball lightning on Sept. 6, and brief report of one in N. Pacific 13½°N, 94°W on July 17, 1951. *Subject Headings:* **1. Hurricanes 2. Tropical cyclones 3. West Indies 4. North Pacific.**—*C.E.P.B.*

4.2–114 551.515.2

Williams, C. H., **The hurricane at Jamaica, August 1951.** *Marine Observer*, 22(157):155–156, July **1952.** fig., photo. **DWB**—*Subject Headings:* **1. Hurricanes 2. Jamaica.**

4.2–115 551.515.2:06

World Meteorological Organization. Eastern Caribbean Hurricane Committee, **Report of second meeting, Trinidad, June 16–19, 1952.** 13+p. **DWB**—Members of the Committee from Canada, U. S. and various governments in the Caribbean are listed and the minutes of the meeting, recommendations and reports of working groups are presented. A summary of North Atlantic Hurricane and other tropical cyclone activity during 1951 prepared by the U. S. Weather Bureau from shore and weather ship reports is appended. *Subject Headings:* **1. Hurricane warning services 2. Meteorological conferences 3. Caribbean. I. U. S. Weather Bureau.**—*M.R.*

4.2–116 551.515.21:551.542(52)

Hashimoto, M., **On the movement of typhoon (2).** *Journal of Meteorological Research*, Tokyo, 3(14/15):467–473, Dec. **1951.** 6 figs., 3 refs., 14 eqs. In Japanese, English summary, p. (31). **MH-BH**—A method is proposed, to compute from weather charts, the general pressure field which decides the movement of typhoon, and by this method it is possible to obtain the general pressure field from surface and 500 mb weather charts. The relation between the general pressure field and the observed velocity of the typhoon is investigated qualitatively and quantitatively. It is found that the velocity of a typhoon depends not only

on the general pressure field at the surface but also on that at 500 mb level. *Subject Headings:* 1. Typhoon tracks 2. Pressure fields 3. Typhoon velocities 4. Japan.—*Author's abstract.*

4.2–117 551.515.21

Jordan, Charles L., **On the low-level structure of the typhoon eye.** *Journal of Meteorology*, 0(4):285–290, Aug. 1952. 6 figs., 2 tables, 7 refs. **DWB**—Dropsonde and aircraft soundings n 8 typhoons in W. Pacific are combined in curves of mean temperature and dew point in nd outside eye for heights up to 3 km. The eye shows greater stability and higher more variable temperatures. Air in eye was either very dry or nearly saturated. A dropsonde rom 500 mb indicated dry adiabatic descent from 200 mb to about 1 km. Structure of eye is: subsidence layer down to 500–700 mb, vertical and lateral mixing with some cloud down to a shallow moist sub-cloud layer with no vertical mixing. *Subject Heading:* 1. Typhoon structure. —*C.E.P.B.*

4.2–118 551.515.21

*Jordan, Elizabeth S. (*Univ. of Chicago*), **An observational study of the upper wind-circulation around tropical storms.** *Journal of Meteorology*, 9(5):340–346, Oct. 1952. 14 figs., 10 refs. **MH-BH**—All available (130) wind data, 4000–45,000 ft, in Pacific and Atlantic tropical storms were combined and plotted with reference to storm center. Charts show large-scale features—tangential cyclonic velocity (kn) at 7000, 18,000, 30,000, 40,000 and 45,000 ft (from 30,000 ft up, anticyclonic circulation encroaches on center), vertical shear, vorticity, and radial component and stream lines at 7000 and 45,000 ft. The latter shows a ring of outflow and clockwise circulation round an inner core where circulation is still cyclonic. *Subject Headings:* 1. Hurricane structure 2. Wind data.—*C.E.P.B.*

4.2–119 551.515.21:551.511

Mantis, Homer T., **A model of a tropical cyclone in the steady state.** *New York University. College of Engineering, Meteorological Papers*, 1(3), May 1950. 39 p. 14 figs., 4 tables, 28 refs., 22 eqs. List of symbols and constants. **DWB**—Ignoring diffusion of mixing, radiation, conduction and friction (except at the ground), and assuming steady state, Coriolis force, and circular symmetry, a tropical cyclone model has been constructed which follows the hydrodynamic and thermodynamic equations for flow. The problem of the outflow aloft has been treated along the lines suggested by Durst and Sutcliffe (1938) and extended by Sawyer (1947), Miller (1945), Koehler (1947) and Haurwitz (1949). The vertical and horizontal distribution of wind, temperature, pressure and other parameters are calculated for distances of 30 to 400 km from center and heights from surface up to 20 or 40,000 ft depending on the element. The model is based on the conditions which would exist in a mature cyclone, and checked against the actual conditions in the Florida hurricane of Oct. 18–19, 1944. It is shown that the release of latent heat of condensation, and heat added by frictional dissipation are both important in producing the radical temperature difference at the top of the frictional layer. Assuming the top of the system to be 20 km, then heating by descending air is necessary to satisfy conditions near the surface; also oscillation in flow should exist, making it necessary to consider frictional influences arising from eddies near the perimeter of the cyclone. The model works very well for the lower regions near the center (30 km) but not so well for the outer and upper portion. *Subject Headings:* 1. Hurricane structure 2. Cyclone models.—*M.R.*

4.2–120 551.515.21(716)

Potter, John, **Notes on the structure of a hurricane in its late mature stage.** *American Meteorological Society, Bulletin*, 33(3):122–123, March 1952. 3 figs., 2 refs. **MH-BH**—The data were obtained during a hurricane passage at Halifax in Aug. 1950. A hypothetical cross-section on time sequence during the hurricane passage, a graph of dry bulb temperature and dew point temperature and a map showing six-hourly positions of the hurricane center are shown. An 8° drop was observed immediately on entrance into the eye; after eye had passed winds did not exceed 50 mph and no surface precipitation was observed. *Subject Headings:* 1. Hurricane structure 2. Halifax, Nova Scotia.—*I.L.D.*

4.2–121 551.515.21

Wobus, Hermann B., **Some aspects of surface and low level flow in an established hurricane.** Norfolk, Va., U. S. Bureau of Aeronautics Project AROWA, Dec. 16, **1951.** 34 p graphs, charts. **DWB**—Notes and charts presented at a seminar held on Nov. 16, 1951 and conducted by Mr. Wobus of the U. S. Weather Bureau. An attempt was made to create a more realistic model of surface flow and vorticity effects in the vicinity of a hurricane, than was possible by using the Rankine equations where a sudden change from no circulation (in the outer part) to maximum circulation (for the inner part) took place. Velocity profiles for various radii and various types of circulation are shown and compared with calculations made from the Rankine equations. Variation of wind from one quadrant to another as shown by streamlines embedded in general flow pattern are also represented. Anticyclonic vorticity at the entrance zone, and cyclonic vorticity within the storm produce various forms of flow and accelerations when air intrudes across the isobars under different conditions of pressure gradient, etc. Dynamic spirals are thus explained, and it is suggested that the dynamic stability of the entrance ridge could be tested by trajectory observations of a succession of low level balloons released upstream from this ridge. Two types of flow are shown in a model—the stable and unstable. *Subject Headings:* **1. Hurricane dynamics 2. Vorticity 3. Streamlines 4. Dynamic spirals. I. U. S. Bureau of Aeronautics, Project AROWA II. Project TED UNL-MA-501 III. Kotsch, W. J.** (*ed.*).—*M.R.*

4.2–122 551.515.23:656.608(265)

Baldwin, Hanson W. (*Military Editor, N. Y. Times*), **When the Third Fleet met the Great Typhoon.** *New York Times Magazine*, p. 18–19, 48–52, Dec. 16, **1951.** illus. **DWB**—The disaster to the 3rd Fleet, caused by a typhoon on Dec. 17 and 18, 1944 to the east of Luzon Island, is described in popular style. Details of the hardships and losses suffered by the fleet are given. A barometer reading of 27.30 in. and a wind velocity of 124 knots are claimed. Photographs of wrecked and of damaged ships and a radarscope photograph are presented. It is pointed out that "large errors" had been made in locating the storm. *Subject Headings:* **1. Typhoon damage 2. Typhoon tracking 3. Marine disasters 4. Pacific Ocean.**—*G.T.*

4.2–123 551.515.23(263)

**Early hurricanes of 1951.** *Weatherwise*, 4(5):105–106, Oct. **1951.** fig. **MH-BH**—Brief descriptive notes on the hurricanes "Able," "Baker," "Charlie," "Dog," "Easy" and "Fox." *Subject Headings:* **1. Hurricanes 2. Hurricane tracks.**

4.2–124 551.515.23(52)

*†§Japan. Central Meteorological Observatory, Tokyo, **Data of the typhoon "Ruth."** *Japan. Central Meteorological Observatory, Tokyo, Memoirs*, 37(1/2):1–178, **1952.** tables, charts, 64 plates, bibliog. p. 259–276. In Japanese, foreword and legends in English. **DWB**—This rich collection of data has been published as a contribution to a typhoon research project conducted by the Central Meteorological Observatory of Japan since 1951 (the project is planned for 3 years). The report covers the period Oct. 13–16, 1951, during which the typhoon "Ruth" occurred. It contains surface observations for 170 stations, synoptic charts, aerological data for 15 stations, detailed description and illustrations of the path of the typhoon and results of dropsonde observations and of observation of sferics. A bibliography of 284 items on tropical cyclones (about half in Japanese) is added. Sample recordings (128) of pressure, wind, temperature and humidity are presented. *Subject Headings:* **1. Typhoon "Ruth" (Oct. 1951) 2. Tropical cyclone bibliographies 3. Typhoon data 4. Japan.**—*G.T.*

4.2–125 551.515.23(52)

*Japan. Central Meteorological Observatory, Tokyo, **Report of the typhoon "Jane."** *Japan. Central Meteorological Observatory, Tokyo, Memoirs*, 36(1/4):1–281; (1)–(5), Dec. **1951.** figs., tables, refs. In Japanese, English summary p. (1)–(5), following p. 281. **DWB**—A sizeable contribution to the study of typhoons. Tabulated data, reproductions of records, photographs and charts are presented for surface and upper air observations, synoptic situations, tides and resulting damage. A detailed description of the development of the "Jane"

yphoon in Sept. 1950 is given and meteorological phenomena connected with it discussed. he report includes 8 special studies: 1) on the structure of the typhoon (S. SAITO), 2) on ydrodynamic effects (K. KANAYA), 3) aerological conditions (S. KOBAYOSHI), 4) meteoro- gical changes (I. KIMURA), 5) physical processes (K. UWAI), 6, 7) tides (T. SHIODA, Y. IASHIMOTO) and 8) pulsation due to the typhoon (H. SATO). *Subject Headings:* **1. Typhoon ata 2. Typhoon "Jane" (Sept. 1950) 3. Japan. I. Saito, S. II. Kanaya, Kozo III. Ko- ayashi, S. IV. Kimura, I. V. Uwai, K. VI. Shioda, T. VII. Hashimoto, V.**—*G.T.*

4.2–126 551.515.23(52)

*Japan. Central Meteorological Observatory, Tokyo, **Report of the typhoon "Kezia."** *apan. Central Meteorological Observatory, Tokyo, Memoirs*, 35(4):296–511; (11)–(14), **1951.** gs., photos, tables. In Japanese (some legend in English). English summary, p. (11)–(14), ollowing p. 511. **DWB**—A large amount of data and observations is presented in this detailed eport, covering every phase of the passage of typhoon "Kezia" over Japan in September 1950. he generation, development, decay and movement of the typhoon is described and its struc- ure analyzed. Data, presented in tables, graphs and charts, include surface and upper air bservations and information on the distribution of rainfall, the pulsatory motion, river floods. igh tide, damage, etc. The report also includes 5 special studies on various aspects of the yphoon, such as: 1) its inner structure over South Kyushu (K. HASHIMOTO); 2) the pressure rofile near its center (K. UWAI); 3) the pulsatory motion at Fukuoka (R. TSUTSUMI); 4) the ulsatory motion at Oita (T. ONO), and 5) the high tides (S. YAMADA). *Subject Headings:* **. Typhoon data 2. Typhoon "Kezia" (Sept. 1950) 3. Japan. I. Hashimoto, K. II. Uwai, K. II. Tsutsumi, R. IV. Ono, Y. V. Yamada, S.**—*G.T.*

4.2–127 551.515.23:629.13

Montague, Hal R., **Vulture George reconnaissance track.** *U. S. Air Force, 2143D Air Veather Wing, Technical Bulletin*, 1(7):31–35, June **1951.** 2 plates. **DWB**—The author resents an analysis of the Vulture George reconnaissance track which was flown from Guam n a north south direction and below the 500 mb level. Evidence on the formation of vortices btained by the flight is discussed. *Subject Headings:* **1. Tropical cyclones 2. Atmospheric listurbances 3. Airplane weather reconnaissance 4. Guam.**—*I.L.D.*

## RADIATION AND TEMPERATURE

### RADIATION

*See also items:* 4.2–50, Absolute pyrheliometer of K. Wegener (Georgi); 4.2–60, Night cooling under clear sky (Saunders); 4.2–277, Atmospheric polarization, solar radiation (Smosarski); 4.2–289, Intensities of UV features of auroral spectrum (Petrie and Small)

4.2–128 551.521.1

Häsing, J., **Über ein Verfahren zur Verifizierung des Cosinus-Gesetzes für globale Strahlungsmessungen.** [On a method to verify the cosine law for global radiation measure- nents.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:358–360, **1952.** ig., table, 3 eqs. **DWB**—A radiation recorder with a flat receiving surface, inclined 38–39° owards the horizon and rotating about a vertical axis, with a sensitivity proportional to $\cos^3$ angle between radiation direction and that of maximum sensitivity), gives a record nearly proportional to the cosine of the zenith distance of the sun. Two such recorders can replace a global recorder. *Subject Headings:* **1. Global radiation 2. Radiation meters.**—*C.E.P.B.*

4.2–129 551.521.1(058)

*Japan. Central Meteorological Observatory, Tokyo, **Pyrheliometric Bulletin.** First ssue received 1939, published **1952.** Last number received 1950, published **1951.** In English, itle page in English and Japanese. **DWB**—Observations of direct solar radiation began in 1932 in Japan. At present about 30 stations are equipped with Abbot type silver-disk pyrheli- ometers constructed by the Central Meteorological Observatory (CMO), Tokyo. Results

are compared with standard instrument at CMO. Annual reports give extensive data fo each month and stations, when sky is clear at 9 h, 12 h and 15 h local time. The paramete $I$, sec $Z$, $I/I_0$, $A$, $b$, $t$, $e$, $N$ and $T_0$ (Feussner and Dubois coefficient of turbidity). The 193 issue contains data for stations in Korea, Sakhalin and for Dairen, Saipan and Ponape. *Su ject Headings:* **1. Pyrheliometric data 2. Solar radiation networks 3. Annual reports 4. Kore 5. Sakhalin 6. Dairen 7. Saipan 8. Ponape.**—*M.R.*

4.2–130 551.521.1:551.588.2:551.584.

Kaempfert, Wolfgang and Morgen, Alois, **Die Besonnung.** [Insolation.] *Zeitschri für Meteorologie*, 6(5):138–146, May **1952.** 6 figs., 2 tables, 15 refs. **DWB**—The autho discusses recent German studies on microclimate mapping and points out the importance o radiation in determining microclimatic characteristics. On the basis of extensive measure ments of radiation the author presents a series of graphs showing radiation: 1) on a souther slope, 2) on a southeast (southwest) slope, 3) on an east (west) slope, and 4) on a norther slope, and annual totals of radiation in 1000 cal/cm² of different slopes and inclination of 0°- 90°. The method of calculation is described. *Subject Headings:* **1. Radiation measurement 2. Orographic effects 3. Microclimate mapping 4. Radiation on oriented slopes 5. Germany** —*I.L.D.*

4.2–131 551.521.1:551.526(61

Masson, Henri, **Contribution à l'étude du réchauffement de l'eau sous l'effet de la radia tion solaire.** [Contribution to the study of the heating of water by solar radiation.] *Institu Français d'Afrique Noire, Dakar, Bulletin*, 14(2):389–404, April **1952.** table, 4 graphs, fig. photos. **DWB**—The purpose of the experiments reported in this paper was to find an eco nomical way of increasing the thermal storage capacity of water used as a source of energy Experiments were made at Dakar and included measurement of water temperature in still and flowing water exposed to solar radiation with or without protective devices such as various kinds of oil or a glass screening. Comparative data of water temperature are presented and the effect of wind and of rain evaluated. Daily values of total solar radiation recorded at Dakar from Nov. 1950 to July 1951 are tabulated. *Subject Headings:* **1. Solar heating 2. Wate temperatures 3. Solar water heaters 4. Radiation measurements 5. Dakar, French West Africa.**—*G.T.*

4.2–132 551.521.11

Hancock, Donald Strongman, **Sunshine in England and Wales.** *Weather*, 7(10):309 Oct. **1952. MH-BH**—Seasonal means, extremes and frequencies of sunshine in England and Wales. *Subject Headings:* **1. Sunshine duration data 2. England 3. Wales.**—*C.E.P.B.*

4.2–133 551.521.11

Koch, Horst Günter, **Eine auffällige Abnahme der Sonnenscheindauer in Jena.** [A remarkable decrease of sunshine duration in Jena.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:205–213, **1952.** 2 figs., 8 tables, 6 refs. **DWB**—Sunshine totals at Jena 1892–1949 show a marked decrease from 1917–1940. This is not shared by other German stations. Due partly to growth of trees and erection of buildings and factory chimneys, partly to weather and partly to deterioration of Campbell-Stokes sunshine sphere. Raising instrument by 10 m in 1942 and a new recorder both decreased loss. *Subject Headings:* **1. Sunshine duration data 2. Jena, Germany.**—*C.E.P.B.*

4.2–134 551.521.11(42)

Simmons, D. J., **Sunshine records.** *Weather*, 7(7):228, July **1952.** table. **DWB**— Sunshine records at Sandown, I. of Wight, 1912–1951, show a remarkable secular increase. *Subject Headings:* **1. Sunshine duration data 2. England.**—*C.E.P.B.*

4.2–135 551.521.12(437)

*Schindler, G., **Registrierungen der Globalstrahlung in NW-Böhmen.** [Records of global radiation in NW Bohemia.] *Meteorologische Rundschau*, 5(3–4):50, March–April **1952.** 2 tables. **DWB**—Tables of means and extremes 1941–45 with a Robitzsch actinograph at

Podersam (50°13N, 13°24E). *Subject Headings:* **1. Actinometric data 2. Global radiation 3. Czechoslovakia.**—*C.E.P.B.*

4.2–136 551.521.3:551.510.42

Vittozzi, Pio, **Coefficiente di diffusione per un granulo di polvere vulcanica, nel caso di energia incidente su di esso secondo tutte le direzioni.** [Coefficients of diffusion for a particle of volcanic dust and the case of incident energy coming from all directions.] *Geofisica Pura e Applicata*, 22(3/4):195–204, April/June 1952. 2 figs., 4 tables, 3 graphs, ref., 47 eqs. Italian and English summaries p. 195. **MH-BH**—In the present paper the energy scattered by a grain of volcanic ash in each of the two hemispaces individuated by a plane passing through the figure centre of the grain, in the case of a beam of parallel rays incident on it, the direction of the rays forming an angle $\zeta$ with the normal to the considered plane is determined. One arrives at the conclusion that, varying $\zeta$ from 0 to $\pi$, the energy, scattered in the hemispace of the light origin varies from 26‰ to 130‰ of the incident energy and, vice-versa, the energy scattered in the hemispace in which the light continues its way, varies from 130‰ to 26‰ of the incident energy; and that, in the case in which the light in incident on a grain from all the directions contained in the solid angle $2\pi$, a 38‰ is scattered in the hemispace of the light and a 118‰ in the other hemispace, while as it is obvious, in each case the ratio between scattered energy and incident energy is constant and equal to 0.156. *Subject Headings:* **1. Scattering of light 2. Volcanic dust 3. Scattering coefficient.**—*Author's abstract.*

4.2–137 551.521.31:551.576.11

Hartmann, Wilhelm, **Das zenitale Himmelslicht und atmosphärische Vorgänge.** [The zenithal sky light and atmospheric processes.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:355–357, 1952. 3 figs., 3 tables, eq. **DWB**—A commercial Ikot light meter, which includes a photocell, can be used to measure the zenithal skylight and density of clouds. The light from cloudless skies in each month serves for calibration. Some examples of diurnal variation are given. *Subject Headings:* **1. Sky brightness 2. Cloud density.**—*C.E.P.B.*

4.2–138 551.521.32

Barbier, Daniel, Dufay, Jean, and Williams, Donald, **Recherches sur l'émission de la raie verte de la lumière du ciel nocturne.** [Investigations on the green ray emission of the nocturnal skylight.] *Annales d'Astrophysique*, Paris, 14(4):399–437, 1951. figs., tables, refs., eqs. French summary p. 399. **DLC**—Measurements of the radiation intensity of 5577$\mu$ and 5180$\mu$ are made and the corrections for extinction and diffusion are discussed. The diurnal and annual variations are described. The radiation of 5180$\mu$ comes from a height of 460 km. The green ray component of the radiation 5577$\mu$ seems to come from 215 km. The relationships between the wave intensities are studied. A good correlation is found. *Subject Headings:* **1. Nocturnal radiation 2. Night sky emission theories.**—*A.A.*

4.2–139 551.521.32:536.33

Plass, Gilbert N. and Warner, Douglas (*Johns Hopkins Univ.*), **Influence of line shift and asymmetry of spectral lines on atmospheric heat-transfer.** *Journal of Meteorology*, 9(5):333–339, Oct. 1952. fig., 10 refs., 20 eqs. **MH-BH**—The model of the stratosphere proposed by Strong and Plass assumed that the spectral lines had the Lorentz shape. Actually the center of the line shifts to a lower frequency by an amount proportional to the pressure, and the shape of the line becomes asymmetrical at large distances from the center. The effect of the line shift on atmospheric heat-transfer is shown to be small and can be neglected except for very accurate calculations. On the other hand, for the strong spectral lines that play the dominant role in determining atmospheric heat-transfer, the difference between the results calculated using the Lorentz and asymmetrical line-shapes is large. A discussion is given of the effect of the asymmetry on the actual bands of interest in the atmosphere. The difficulties of making exact theoretical calculations of atmospheric heat-transfer are also discussed. *Subject Headings:* **1. Heat transfer 2. Spectral line shift.**—*Authors' abstract.*

4.2–140 551.521.32:551.51

Poppendiek, Heinz F. (*Univ. of Calif.*), **A periodic heat-transfer analysis for an atmospher in which the eddy diffusivity varies sinusoidally with time and linearly with height.** *Journc of Meteorology*, 9(5):368–370, Oct. **1952.** 2 figs., 6 refs., 10 eqs. **MH-BH**—Author gives solution of the heat transfer in the lower atmosphere in which boundary temperature varie sinusoidally with time and eddy diffusivity linearly with height and sinusoidally with time Results are compared with observed changes of eddy diffusivity in Mojave Desert with heigh and time. *Subject Headings:* **1. Heat transfer 2. Eddy diffusivity 3. Mojave Desert, Cal.**— *C.E.P.B.*

4.2–141 551.521.3

Sato, Takao (*Tohoku Univ.*), **Research on the tertiary scattering of the sun's ray in th earth's atmosphere.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 30(2):33–52, Feb **1952.** 12 figs., 2 refs., eqs. **MH-BH**—The author points out that tertiary scattering ha to be taken into consideration in order to account for twilight when the sun's position is mor than 100° from zenith. For accurate calculations regarding day-time radiation it is als necessary to consider tertiary scattering. A detailed theoretical analysis of tertiary scatterin is given for various positions of the observer, with geometrical diagrams illustrating the case and mathematical formulas giving integrated values of tertiary scattering. *Subject Headings* **1. Tertiary scattering 2. Radiation calculations 3. Twilight 4. Japan.**—*G.T.*

## TEMPERATURE

*See also items:* 4.2–47, Micrometeorological temperature measurements from aircraft (Albrecht); 4.2–60, Night cooling under clear sky (Saunders); 4.2–101, Synthetic climatology (Lettau); 4.2–154, Water temperature and ice, Steinhuder Lake (Friedrich); 4.2–268, Microclimate and late frosts in NE Vogelsberg (Knapp and Knapp)

4.2–142 551.524:551.577:519.241.1

Krames, Karl, **Die Korrelation zwischen Temperatur- und Niederschlagsanomalien im Winter der Nordhemisphäre.** [The correlation between winter anomalies of temperature and precipitation in the Northern Hemisphere.] *Geografiska Annaler*, 33(3–4):210–229, **1951.** fig., 2 tables, 21 refs. **DWB**—Correlation coefficients between temperature and precipitation are calculated for Dec., Jan. and Feb. on the basis of the World Weather Records and chart presented. In the westerlies, a positive correlation usually exists for the continents and a negative one for the oceans. Special attention is given to the conditions in mountain regions. An assumed climatic variation from 1900 and the effect on glaciers is discussed. *Subject Headings:* **1. Temperature-precipitation correlations 2. Climatic variations 3. Glaciers.**—*A.A.*

4.2–143 551.524.1:551.551

Gerhardt, John Randolph, Crain, Cullen Malone and Smith, H. W. (*Univ. of Texas*), **Fluctuations of atmospheric temperature as a measure of the scale and intensity of turbulence near the earth's surface.** *Journal of Meteorology*, 9(5):299–310, Oct. **1952.** 9 figs., 3 tables, 22 refs., 15 eqs. **MH-BH**—Quick-response bead thermistors were exposed on a line perpendicular or parallel to mean wind, or both, 38 or 21 in. above ground at Manor, Texas, at distances from no. 1 of about 0.5, 2, 4.2, 7.5 and 12 ft. Records were automatically correlated for different times and distances and results analyzed in detail to find the average sizes of the turbulence elements (between 1 and 5 m) producing inhomogeneities. It was found that over the surface considered (weeds and grasses up to 1 ft) the scale of turbulence varies from 3–15 ft greater downwind than crosswind, and independent of wind speed. *Subject Headings:* **1. Temperature microvariations 2. Turbulent flow.**—*C.E.P.B.*

4.2–144 551.524.2:551.524.36(494,45)

*Thams, J. Chr. (*Locarno-Monti*), **Die sommerliche Wärme nord- und südwärts der Alpen.** [Summer temperature north and south of the Alps.] *Leben und Umwelt*, Aarau, Switzerland, 6(5):110–114, Feb. **1950.** 4 tables. **DLC**—Continuous observations for the period 1929–1948 at Basel, Locarno-Monti (Switzerland) and at Lugano (Italy) were used in the

nvestigation. The author compares the absolute highest and lowest temperatures, mean naximum and minimum data and duration of so-called summer days (when temperature does ıot fall below 25°C). The comparison shows that the mean maximum temperatures during 'summer" days in June, July and Aug. are higher in Basel than in Lugano, but the mean vening and night temperatures are higher in Lugano. Mean duration of sunshine for the ame time in Basel is 10.0 hours, in Lugano it is 9.6 hours. *Subject Headings:* **1. Temperature omparisons 2. Summer temperatures 3. Switzerland 4. Lugano, Italy.**—*N.T.Z.*

4.2–145 551.524.4: 551.584.4(438)

Kosiba, Aleksander, **Zagadnienie pionowych różnic klimatycznych w przyziemnych ıarstwach atmosfery.** [The question of vertical climatic differences in the lowest strata f the atmosphere.] *Przegląd Meteorologiczny i Hydrologiczny, Rocznik*, 1950–1951:98–110, 951. fig., 3 tables. English summary p. 108–110. **DWB**—This is a comparative analysis f temperatures at standard level of 2 m above ground level and at 5 cm height. The measure- ıents were made at the Institute of Meteorology and Climatology of the Wroclaw University uring 1949. Monthly and yearly values of: mean temperatures taken 3 times daily, average nd absolute temperature minima and maxima, mean daily amplitude, highest and lowest aily mean temperature, as well as the number of days with characteristic temperature at both ɔvels are tabulated and discussed. The author emphasizes the importance of these tem- ɔerature differences and the need of further investigations of the phenomenon with regard to griculture. *Subject Headings:* **1. Vertical temperature gradient 2. Microclimatology . Temperature variations 4. Agricultural meteorology 5. Poland.**—*A.M.P.*

4.2–146 551.524.4

Takeda, K., **On the vertical air temperature distribution in the lowest layers of the tmosphere.** *Journal of Agricultural Meteorology*, Tokyo, 7(1):1–3, Dec. 1951. 3 figs., refs., eqs. English summary p. 3. **DWB**—Author discusses recent publications of F. Pas- uill on simultaneous measurements of wind velocity, absolute humidity and air temperature 'hich show a constant deviation from logarithmic law in temperature, wind and humidity rofiles. In trying to explain this deviation, author presents equations accounting for tur- ulence and finds that as far as temperature profile under stable conditions and humidity rofile under both stable and unstable conditions are concerned, theoretical conclusions are in greement with Pasquill's results. The disagreement in the case of temperature profile nder unstable conditions is tentatively attributed to either radiative transfer or buoyancy. *'ubject Headings:* **1. Vertical temperature gradient 2. Temperature profiles 3. Atmospheric ırbulence.**—*G.T.*

4.2–147 551.524.7:551.510.534

Regener, Erich, **Zur Erklärung der Warmlufteinbrüche in die untere Stratosphäre.** On the explanation of warm air inbreaks in the lower stratosphere.] *Germany. Deutscher Vetterdienst in der US-Zone, Berichte*, No. 38:289–291, 1952. 2 figs., 9 refs. **DWB**—Ab- ormally high stratosphere temperature at 20–30 km on 3/14/52 is attributed to a deep ozone ɔyer brought down by strong vertical turbulence. *Subject Headings:* **1. Temperature of the ɔratosphere 2. Ozone variations.**—*C.E.P.B.*

4.2–148 551.524.7:551.590.21

Scherhag, Richard, **Die explosionsartigen Stratosphärenerwärmungen des Spätwinters 951/1952.** [The explosion-like stratospheric warmings of the late winter 1951/1952.] *ermany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:51–63, 1952. 10 figs., tables, 13 refs. German and English summaries p. 51–52. **DWB**—In 1951–52 radiosondes om Berlin reached heights of 30–40 km. These showed at high levels in winter rapid rises f temperature by 30–50°C. Examples tabulated are Jan. 25–30 and Feb. 22–29, 1952. imilar changes are quoted at Copenhagen and Thule and the change on Feb. 22–29 at 41 mb mapped. The changes are associated with daily magnetic activity and attributed to solar ɔuptions. The corresponding sudden surface pressure changes lead to errors in weather ɔrecasts. *Subject Headings:* **1. Upper air temperatures 2. Solar influences.**—*C.E.P.B.*

## SOIL TEMPERATURE

*See also item:* 4.2–101, Synthetic climate (Lettau)

4.2–149 551.525.2:581.036.

Bruhin, Alfred, **Auslösung von Mutationen in ruhenden Samen durch hohe Temperaturen** [Release of mutations in quiescent seeds by high temperatures.] *Naturwissenschaften* 38(24):565–566, Dec. **1951.** 2 figs., table, 11 refs. **DWB**—Mutations of *Crepis aurea* in creased up to vegetation limit (3000 m) in Alps. This is attributed to modifications of chromo somes by high soil temperatures in sheltered situations. *Subject Headings:* **1. Mutatio 2. Plant ecology 3. Soil temperatures.**—*C.E.P.B.*

4.2–150 551.525.

Gloyne, R. W., **Daily maximum temperature of the surface of the ground.** *Meteorological Magazine*, London, 81(961):203–206, July **1952.** 9 refs., 3 eqs. **DWB**—Writing $T$ = maximun temperature °F of a "surface" soil layer a few mm thick, $T'$ for "skin" soil temperature and for screen maximum, in hot weather the approximate relations are quoted: $T = 2t - 50$; $T = T + 15$. *Subject Heading:* **1. Soil surface temperatures.**—*C.E.P.B.*

4.2–151 551.525.2:551.586:6

Tsuboi, Y. and Yukino, T., **Characteristics of soil temperatures in field of rice plante directly.** *Journal of Agricultural Meteorology*, Tokyo, 6(3/4):188–190, Aug. **1951.** 4 figs tables. In Japanese, English summary p. 190. **DWB**—Graphs and data show that th temperature at 2.5 cm depth was higher throughout the day and night in "kneaded" than i "unkneaded" soil, except for a short period in the early afternoon. At 5, 10 and 20 cm th period and intensity of reversal in the afternoon is greater. Based on comparison of 2 plot for rice germinating and growth studies. *Subject Headings:* **1. Soil temperatures 2. Ric culture 3. Agricultural meteorology 4. Japan.**—*M.R.*

4.2–152 551.525.

*Baier, W., **Ergebnisse von Bodentemperaturmessungen.** [Results of soil temperatur measurements.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:189–195 **1952.** 6 figs., 5 tables, 2 refs. **DWB**—From 70 years of observation at Hohenheim, monthl tables are compiled of mean temperatures in air and at depths of 2–100 cm in bare soil an under grass. Relations between air and soil temperatures are discussed. *Subject Headings* **1. Soil temperatures 2. Long period records 3. Hohenheim, Germany.**—*C.E.P.B.*

4.2–153 551.525.4(47

Kraskovskiĭ, S. A., **O normal'nom temperaturnom gradiente zemnoĭ kory.** [The norma temperature gradient of the earth's crust.] *Vsesoiuznoe Geograficheskoe Obshchestvo, Izvestiia* 83(5):523–525, Sept.–Oct. **1951.** 11 refs. **DWB**—An article questioning the correctness o the widely accepted theory evaluating the so-called mean temperature gradient of the earth' crust at 32°/km. Through a review of historical material, the author shows how this value o gradient originated and was adopted by science. First, he asserts that this mean valu calculated according to values obtained by Cordier, Reich, Naumann, Everett, Presto wich, Thoma, Königsberger (which were all different) and taken with aid of inert an Magnus geothermometers in bore holes made in sedimentary rocks is not precise and absolute since overwhelming accurate thermic material for all parts of the globe is now available. How ever, no complete analysis of this material has yet been made. The use of a statistical metho for obtaining the mean gradient, as applied by H. Landsberg at the University of Chicago i 1946–1947, without discounting geological conditions is, according to the author, incorrect. I general, the application of such a mean gradient obtained in sedimentary rocks for calculatin the thermic flow and solving other theoretical and practical problems is basically wrong. Suc calculations can be made only on the basis of a "normal" gradient of the earth's crust, obtaine by measuring the temperature in crystalline rocks forming the structure of the earth's crust but not in sedimentary rocks. Up to now the number of temperature measurements i crystalline rocks are not great but even these results show that the gradient in crystalline rock

ffers much from the gradient of sedimentary series. All of them (gradients) lie in the interval etween 6–18°/km. The normal gradient of the earth's crust will probably not surpass )–12°/km, which is three times smaller than the value now prevailing. *Subject Headings:* **Earth temperatures 2. Temperature gradient 3. U.S.S.R.**—*A.M.P.*

## SEA TEMPERATURE

*See also item:* **4.2–131**, Heating of water by solar radiation (Masson)

4.2–154 551.525.6:551.524:551.311.1

Friedrich, Wilhelm (*Bielefeld*), **Wassertemperatur und Eisverhältnisse des Steinhuder eeres.** [Water temperature and ice conditions of Steinhuder Lake.] *Neues Archiv für iedersachsen*, Bremen, No. 21:1–7, **1951.** 4 figs., 4 tables, 3 refs. Abstracted from reprint. **WB**—The close relationship between 8 A.M. air and water temperature for the period 1939–)49 is shown in tabular and graphic form. Special attention is paid to the effects (on that lationship) of the disappearance of ice in spring, the maximum temperatures in summer, and e formation of ice in winter. *Subject Headings:* **1. Sea temperatures 2. Air temperatures Ice 4. Steinhuder Lake.**—*M.P.K.*

4.2–155 551.526.6(261)

Rodewald, Martin, **Normalwerte und Abweichungen der Meerestemperatur bei den ordatlantischen Wetterschiffen.** [Normals and deviations of sea temperature near the orth Atlantic weather ships.] *Deutsche Hydrographische Zeitschrift*, 5(2–3):131–140, **1952.** figs., 4 tables, 15 refs. German, English, French summaries p. 131–132. **DWB**—Monthly ormals of surface temperature at the locations of 10 N. Atlantic weather ships are compiled om 6 different atlases and the means taken. Deviations from this at each location are bulated Nov. 1950–Dec. 1951, and discussed in relation to monthly charts of pressure devia- ons over the N. Atlantic, vector departures of winds at each location and relations to ocean rrent system. As a whole, temperature was 0.5°C above normal; local differences are plained by an intensified cyclonic movement of the subpolar ocean and a shift of the Gulf ream. *Subject Headings:* **1. Sea temperatures 2. Weather ships 3. North Atlantic.**—*E.P.B.*

# PRESSURE AND WIND

## PRESSURE

*See also items:* **4.2–14**, Standard deviation of atmospheric pressure over N. Hemisphere (Schumann and Van Rooy); **4.2–95**, Atmospheric mechanics in formation of daily pressure waves (Hinkelmann); **4.2–96**, Atmospheric mechanics in development of pressure changes (Hinkelmann); **4.2–116**, Movement of typhoon (Moshimoto); **4.2–167**, Relation: mean vector surface—mean vector pressure gradient over oceans (Gordon)

4.2–156 551.541

Roschke, Walter H., Jr. (*St. Louis Univ.*), **The relation between air-pressure micro-cillations and concurrent synoptic patterns.** *Journal of Meteorology*, 9(3):213–219, June **52.** 5 figs., 2 tables, 13 refs. **DWB**—Micro-oscillations of less than 1 min recorded by acelwane electromagnetic microbarographs are classified as: 1) quiet, 2) transition and 3) aximum (exceeding 0.002 mb). Type 1 accompanies extensive highs in polar continental r, and also occurs briefly during passage of a cold front. Type 2 occurs in maritime tropical returning polar air. Type 3 occurs before and after a cold front, separated by Type 1. *ubject Heading:* **1. Microbarometric oscillations.**—*C.E.P.B.*

4.2–157 551.541:551.515.8

Sonntag, D., **Besondere Erscheinungen im Mikrobarogramm zweier Kaltfronten.** [Pe-liarities in microbarograms of two cold fronts.] *Germany. Deutscher Wetterdienst in der S-Zone, Berichte*, No. 38:91–92, **1952.** 3 figs., 3 refs. **DWB**—Rapid oscillations shown by icrobarograph during passage of cold fronts are illustrated by examples of Aug. 8 and Dec.

12, 1948. The latter shows a remarkable symmetry point. *Subject Headings:* **1. Micro barometric oscillations 2. Cold fronts.**—*C.E.P.B.*

4.2–158 551.542.1:551.553.

Kleinschmidt, Ernst, Sen., **Die Abhängigkeit des gradientbedingten Bodenwindes von der Jahreszeit.** [The dependence on the season of surface winds due to gradient.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:9–12, **1952.** 4 tables, 5 refs. **DWB**—The statement by C. Ley (1877) that with the same gradient the surface wind is stronger in summer than in winter is investigated using Hamburg data. It is found that after reduction to same gradient summer wind is 4.3% *weaker* than winter, and is equal or weaker at all hours. *Subject Heading:* **1. Gradient winds.**—*C.E.P.B.*

4.2–159 551.543:519.

Kaciak, William and Langwell, Patricia A., **Statistical properties of pressure change aloft.** *Journal of Meteorology*, 9(3):172–175, June **1952.** 4 figs., 2 tables, 5 refs., 8 eqs. **DWB**—Daily 3000-gdm pressures in 50°N 70°W were autocorrelated with lags 1–10 days for each season, 1934–1940. Frequency distributions of pressure changes in 3–6 days are found to be normal in winter and summer; in spring and fall pressure departures persist for 10 days. *Subject Headings:* **1. Upper air pressure 2. Statistical studies.**—*C.E.P.B.*

4.2–160 551.543.

Haurwitz, Bernhard, **Zur Resonanztheorie der halbtägigen Luftdruckschwankung.** [On the resonance theory of the semidiurnal pressure variation.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:12–16, **1952.** 12 refs., 17 eqs. German and English summaries p. 12–13. **DWB**—The generally accepted resonance theory, based partly on the semidiurnal temperature wave and partly on the solar atmospheric tide, faces various difficulties, especially the seasonal variations of the structure and wind distribution in the atmosphere. It is shown that the phase retardations of the pressure and temperature oscillations do not change the condition that the forced atmospheric oscillation period must be very near 12 hours. *Subject Headings:* **1. Diurnal pressure variations 2. Resonance theory.**—*C.E.P.B.*

4.2–161 551.543.

Rodewald, Martin, **Besonderheiten der nordhemisphärischen Zirkulation in den Jahren 1949–1951.** [Peculiarities in the Northern Hemisphere circulation in the years 1949–51.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No: 38:63–72, **1952.** 9 figs. 22 refs. **DWB**—The main part of the paper is a discussion of the differences between Baur's (1874–1933) and the Normal Weather Map (1899–1933) mean pressure charts of the N Hemisphere. These are attributed to opposite errors in both, especially in 80–90°N where Baur's means are 3–4 mb lower than those of the Normal Weather Map. The differences of 1949–51 from both are sufficiently alike to show that they are often real; they are confirmed by other evidence and indicate intensification of both highs and lows in middle northern latitudes. *Subject Headings:* **1. Pressure trends 2. Atmospheric circulation. I. Baur, Franz.**—*C.E.P.B.*

## WIND

*See also items:* 4.2–7, Radio echo investigation of atmospheric winds (Greenhow); 4.2–100, Scalar-vorticity, horizontal-divergence equations (Sherman); 4.2–107, Mean jet stream, Australia (Gibbs); 4.2–108, Dynamics of jet stream (Sato); 4.2–111, Hurricanes, 1951 (Grady); 4.2–143, Atmospheric temperature fluctuations, a measure of scale and intensity of turbulence near ground (Gerhardt, Crain and Smith); 4.2–158, Dependence on season of surface winds due to gradient (Kleinschmidt, E., Jr.); 4.2–196, Orographic cirrus (Ludlam); 4.2–208, Rainfall measurements and wind conditions (Kreutz); 4.2–211, Evaporation of droplets falling freely in atmosphere (Kriestanov); 4.2–258, Rick climate, wind influence (Hummel); 4.2–265, Argentine aerology (Georgii); 4B–1 to 4B–342, Bibliography on turbulent diffusion . . . (Kramer, Assur and Rigby)

4.2–162 551.553(261:410

*Dietrich, Günter; Wyrtki, K., Carruthers, J. N., Lawford, A. L. and Parmenter, H. C. **Wind conditions over the seas around Britain during the period 1900–1949.** Hamburg

German Hydrographic Institute, **1952.** 35 p. numerous charts and tables. **GB-MO**—Pt. 1 of this elaborate, statistical summary gives for each month of each year 1900–1949 the N and E wind components in m/sec and the resultant direction and velocity for Shetlands area, Northern, Central and Southern North Sea, Western English Channel and Irish Sea. Average values, with resultant direction and velocity, are given for 1901–30, and vector departures of each month from these averages are shown graphically for the North Sea areas. Similar tables are given where available for years from 1873–1899. In Pt. 2 these results are analyzed into frequency diagrams of monthly means from each direction. *Subject Headings:* **. Wind distribution 2. Wind variations 3. Long period records 4. British seas.**—*C.E.P.B.*

4.2–163 551.553:551.501.6(438)

Okołowicz, Wincenty, **O nowym sposobie graficznym przedstawiania wiatrów.** [A new raphic method for representing winds.] *Przegląd Meteorologiczny i Hydrologiczny*, Warsaw, . 1950–1951:202–204, **1951.** fig. **DWB**—A new method simultaneously considering wind requency, speed, and wind direction. The results of the observations taken in Chojnice in 886–1910, are used as an example. *Subject Headings:* **1. Wind variations 2. Graphical resentation 3. Poland.**—*Wanda Tomcyzkowski.*

4.2–164 551.553.12

Berg, Hellmut, **Beobachtungen des Berg- und Talwindes in den Allgäuer Alpen.** Observations of mountain and valley winds in the Allgäu Alps.] *Germany. Deutscher Vetterdienst in der US-Zone, Berichte*, No. 38:105–109, **1952.** 7 figs., 7 refs. **DWB**—Regular nountain and valley winds occur in March in a N–S side valley of the Lechtal. These were xamined by plotting of simultaneous wind observations and some autographic records. At ight the down wind on valley sides is distinct from colder bottom wind. In the afternoon the own wind appears first on the shaded E side. *Subject Headings:* **1. Mountain and valley inds 2. Allgäu Alps, Germany.**—*C.E.P.B.*

4.2–165 551.553.12(494)

Bouet, Max (*Montana*), **Lokalwinde in der Westschweiz.** [Local winds in western Switzrland.] *Leben und Umwelt*, Aarau, Switzerland, 7(4):91–95, Jan. **1951.** 2 figs. **DLC**—A escription of the conditions which cause local winds. Land and sea breezes are observed ear the Lake of Geneva with great regularity. Mountain and valley winds are usual phe-omena in mountain regions. The Valais canton in southwestern Switzerland is remarkable or its intensive valley winds [called Valais winds (vent du Valais)]. Slope winds are sually recorded near the foot of the Jura mountain range. The distribution of regions with ocal winds is indicated on the map. *Subject Headings:* **1. Local winds 2. Mountain and alley winds 3. Valais winds 4. Switzerland.**—*N.T.Z.*

4.2–166 551.553.21:551.577.3(54)

Rahmatullah, M., **Synoptic aspects of the monsoon circulation and rainfall over Indo-akistan.** *Journal of Meteorology*, 9(3):176–179, June **1952.** 10 figs., 5 refs. **DWB**—Burst of monsoon" coincides with arrival of equatorial convergence zone over N. India and estward shift of trough of low pressure. Both these fluctuate vigorously. On Aug. 1949 ow patterns at 5000 ft fell into 5 different types; these are mapped with corresponding pre-ipitation patterns. *Subject Headings:* **1. Monsoon circulation 2. Monsoon rains 3. India.**—*.E.P.B.*

4.2–167 551.553.6:551.543.6

Gordon, Adrian Hugo (*British Met. Off., Marine Br.*), **The relation between the mean ector surface and the mean vector pressure gradient over the oceans.** *Geofisica Pura e pplicata*, 21:49–51, **1952.** 3 figs., ref. English summary p. 49. **MH-BH**—The mean ector wind for all Marsden (10° sq) squares where there were at least 50 observations of both ind and pressure was computed and its deviation from the calculated mean vector geostrophic ind observed. By averaging the values of the angle of deviation and the velocity ratio, an npirical relation can be obtained for the mean flow of the surface wind across the pressure radient as a function of the latitude and a mean picture of the general circulation in low

latitudes built up. *Subject Headings:* **1. Surface wind variations 2. Pressure gradien variations 3. Atmospheric circulation.**—*M.P.K.*

4.2–168 551.555.3(786

McClain, Paul E. (*Univ. of Washington, Seattle*), **Synoptic investigation of a typical chinoo situation in Montana.** *American Meteorological Society, Bulletin*, 33(3):87–94, March 1952 6 figs., 12 refs. **MH-BH**—A brief review of the more important European and America literature on the origin of föhn winds is presented and a single representative winter chinoo situation is analyzed in detail using surface and upper wind synoptic data. Chinook condition on the eastern slopes of the Rockies in Montana prevailed after a warm upper ridge in the flo pattern became established over the Continental Divide and a strong southeasterly flow wa produced in the lower troposphere east of the mountains by a surface cyclone approaching th North Pacific coast. The air aloft and at the surface in the eastern valleys which gives ris to chinook weather was superior air descending from the upper warm anticyclone and had nc been located previously over the Great Basin region. The evidence of lateral convergenc throughout the troposphere east of the Divide during chinooks, and of simultaneous ascen in the middle troposphere east of the Divide and of descent in the lower troposphere corroborat VON FICKER's föhn theory. High and low level chinooks are distinguished and the characte istics of chinook air are described. *Subject Headings:* **1. Chinook winds 2. Föhn theor 3. Montana.**—*I.L.D.*

4.2–169 551.556:551.46

Bernasconi, Carlo, Bossolasco, Mario and Dagnino, Ignazio, **Nuovo metodo di registra zione dello state del mare e primi risultati a Genova.** [New method of recording the stat of the sea and first results obtained in Genoa.] *Geofisica Pura e Applicata*, 21:159–16 **1952.** 3 figs., 6 refs., 13 eqs. Italian, English and German summaries p. 159. **MH-BH**— The new method described consists of transforming the vertical movement of the sea surfac into compression or expansion of a column of air by means of a sensitive membrane. Analys of early results obtained during the first several months of use at Genoa, indicate the importanc of cold front passage to state of the sea. *Subject Headings:* **1. Ocean wave measuremer 2. Oceanographic instruments 3. Genoa, Italy.**—*M.P.K.*

4.2–170 551.556:532.593:551.46

Bretschneider, C. L., **The generation and decay of wind waves in deep water.** *America Geophysical Union, Transactions*, 33(3):381–389, June **1952.** 5 figs., 25 refs. **MH-BH**— Data on the generation and decay of wind-generated gravity waves have been collected f several years by the University of California. These data, as well as the original data SVERDRUP and MUNK, are analyzed and the results presented in dimensionless graphs suitab for use in wave forecasting. The dimensionless parameters presented by SVERDRUP an MUNK are suitable; however, new curves were constructed which include new data recentl available. In order that the data on the decay of waves could be presented in a logical manne a concept, based upon the following observations, was introduced: (1) Individual waves do n maintain their identity in deep water, (2) a spectrum of lengths and heights is present in bot the fetch and decay areas, (3) at any particular decay distance the significant period decrease with time, (4) the significant period increases with decay distance in a manner different fro that assumed by SVERDRUP and MUNK for their decay relationships, (5) travel time depen upon the group velocity associated with the significant period at the end of the decay distanc It was found that the significant wave height and period at the end of the decay distan depend upon the length of the fetch and height and period at the end of the fetch as well upon the decay distance. *Subject Headings:* **1. Wind waves 2. Wave decay 3. Deep wat waves.**—*Author's abstract.*

4.2–171 551.556:551.461

Defant, Albert, **Theoretische Überlegungen zum Phänomen des Windstaus und d Auftriebes an ozeanischen Küsten.** [Theoretical considerations on the phenomenon of wi thrust and upwelling on oceanic coasts.] *Deutsche Hydrographische Zeitschrift*, 5(2–3):69–8 **1952.** 6 figs., 15 refs., 43 eqs. German, English and French summaries p. 69. **DWB**

The internal mechanism of the piling up or upwelling of water on a coast is discussed using a model of an open ocean with adjacent sea shelf. The results are compared with conditions off the coast of California with good agreement. *Subject Headings:* **1. Wind effects 2. Water surface 3. Upwelling.**—*C.E.P.B.*

4.2–172 551.556:551.465:551.481(759)

Haurwitz, Bernhard (*N. Y. Univ.*), **The slope of lake surfaces under variable wind stresses.** *U. S. Beach Erosion Board, Technical Memorandum*, No. 25, Nov. **1951.** 23 p. 7 figs., refs., eqs. **DWB**—A case study of Lake Okeechobee, Florida, in which the inclination of the surface during a hurricane is analyzed by application of hydrodynamical equations, is used to show the need for considering time lag, direction and speed variability of the generating wind and length of the seiche periods in improving predictions of wind tides. *Subject Headings:* **1. Wind tides 2. Seiches 3. Hurricane winds 4. Lake Okeechobee, Florida.**—*M.P.K.*

4.2–173 551.556:551.465(716)

Longard, J. R. and Banks, R. E., **Wind-induced vertical movement of the water on an open coast.** *American Geophysical Union, Transactions*, 33(3):377–380, June **1952.** 6 figs., 4 refs. **MH-BH**—The effect of winds on the vertical structure of the water column near the Atlantic coast of Nova Scotia is discussed. The analysis is based on twice-daily bathythermograms taken at "Sambro" Light Vessel. This vessel is located in 50 fathoms ten miles offshore in the vicinity of Halifax, Nova Scotia. Strong easterly winds blowing for more than half a day are shown to cause such a shoreward movement of the light surface water than the bottom water may be entirely displaced for at least ten miles offshore. Evidence is presented that this is a wind-driven effect and is not necessarily due to the presence of a low-pressure area in the vicinity. Sea level as recorded on the Halifax tide gage confirms the piling up of surface water. *Subject Headings:* **1. Wind effects 2. Wind waves 3. Sea level variations 4. Bathythermograms 5. Nova Scotia.**—*Authors' abstract.*

4.2–174 551.557

Holzapfel, Rupert, **Über die Schwachwindauswahl bei elektrischen Höhenwindmessungen.** [On the bias in favor of light winds in electric upper wind measurements.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:323–328, **1952.** 3 figs., 5 tables, 7 refs. **DWB**—Radio upper wind measurements are biased in favor of light winds. This is illustrated by comparisons of recorded winds at Berlin at 3 km calculated from ascents reaching 3, 7, 11 and 16 km respectively. *Subject Headings:* **1. Upper air wind data 2. Berlin, Germany.**—*C.E.P.B.*

4.2–175 551.557:551.501:551.507.321.2

Perkins, Donald Theodore (*Hq. U. S. Air Weather Service, Wash., D. C.*), **The response of balloons to the wind.** *American Meteorological Society, Bulletin*, 33(4):135–139, April **1952.** 3 figs., 2 refs., 17 eqs. **MH-BH**—"The effect of lag in the measurement of winds by balloons is described in terms of the effective thickness, describing the layer through which the actual winds are averaged to obtain the measured winds, this thickness being so defined as to include 95% of the effect." The effective thickness ($h$) can be expressed in terms of effective length of balloon (1), the lift ratio ($r$), and the drag coefficient $C_D - h - Ye/C_D r$. The deviation of this equation is presented and the effect of individual parameters upon the effective thickness is discussed. *Subject Headings:* **1. Upper air wind measurement 2. Balloons.**—*From author's abstract.*

4.2–176 551.557:551.513

Petterssen, Sverre, **On the propagation and growth of jet-stream waves.** *U. S. Air Weather Service, Technical Report* 105-80, Nov. **1951.** Also: *Royal Meteorological Society, Quarterly Journal*, 78(337):337–353, July **1952.** 6 figs., 13 refs., 30 eqs. **DWB**—Assuming adiabatic frictionless motion, expressions are derived for propagation and growth of wave-shaped circulation patterns, allowing the wind field to possess such general characteristics as vertical velocity, lateral shear, divergence, etc. The general equations are specialized to apply to sinusoidal wave models resembling the waves that occur in connection with strong concentrated currents (e.g. the jet stream) in the middle and upper troposphere in middle

latitudes. It is shown that the rate of propagation of these waves is determined primarily by the wind speed, wave length, width of the current and the meridional variation of the Coriolis parameter. Growth rate is determined primarily by the meridional variation of the Coriolis parameter and the orientation of the troughs and wedges. The formulas which are recommended for testing by analysts apply to isentropic surfaces but are just as easily used for isobaric surfaces in the mid-troposphere, according to the author. A nomogram is included for calculating relation between U, L, B and C for zonal waves at lat. 45°. Models are presented to illustrate special cases. *Subject Headings:* **1. Jet stream waves 2. Waves in the westerlies forecasting 3. Nomograms.**—*Partly from author's abstract.*

4.2–177 551.557:551.558.2

Preusche, Walter, **Ein Modell zur Veranschaulichung der Vertikalbewegungen in der Jet-Zone.** [A model to demonstrate vertical motion in the jet zone.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:42–46, **1952.** 4 figs., table, 12 refs. **DWB**—A very simplified model of the vertical movements in the jet zone during a continental cold air outbreak on Nov. 25–29, 1946 over Europe is constructed from upper air data. The consequences, applicable in forecasting, are tabulated. *Subject Headings:* **1. Jet stream 2. Vertical motion.**—*C.E.P.B.*

4.2–178 551.558.21:551.576.11

Ludlam, Frank Henry, **Hill-wave cirrus.** *Weather*, 7(10):300–306, Oct. **1952.** 5 figs., 3 plates, 4 refs. **MH-BH**—Ice crystals form in rising air above hills, but continue to grow in the descending lee wave, becoming fibrous cirrus. The physics is discussed and illustrated by photographs, maps and diagrams of cloud formation at Dunstable, England. *Subject Headings:* **1. Cirrus clouds 2. Lee effects.**—*C.E.P.B.*

## AQUEOUS VAPOR AND HYDROMETEORS

### EVAPORATION

*See also item:* 4.2–219, Water economy of Mediterranean compared with Baltic Sea (Wüst)

4.2–179 551.573:551.508.72(58)

Haude, Waldemar, **Zur Möglichkeit nachträglicher Bestimmung der Wasserbeanspruchung durch die Luft und ihrer Nachprüfung an Hand von Tropfversuchen und Abflussmessungen.** [The possibility of determining the maximum water need of plants and the examination of these relationships by evaporimeters and discharge measurements.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 32:27–34, **1952.** 8+4 figs., 4 refs. **DWB**—The author suggests that the maximum water need of plants be calculated by using 1400 h humidity and temperature readings, because it is too laborious and expensive to determine evapotranspiration by measuring the heat balance as was done by the author in central Asia. The author believes that in Germany, where the soil is sufficiently moist, the actual evapotranspiration can also be calculated by the midday values of humidity and temperature. In the discussion of this report KREUTZ gives a description (with 4 photographs) of the improved Popov soil evaporimeter. *Subject Headings:* **1. Evapotranspiration 2. Plant ecology 3. Popov's soil evaporimeter 4. Central Asia. I. Kreutz, W.**—*A.A.*

4.2–180 551.573:551.508.72

Mather, John R. (*Johns Hopkins Univ. Lab. of Climatology, Seabrook, N. J.*), **Micrometeorology of the surface layer of the atmosphere. Manual of evapotranspiration.** Johns Hopkins University. Laboratory of Climatology, Seabrook, N. J., Contract W28-099-ac-378, 21J, Suppl. to Interim Report No. 10, June 30, **1950.** 29 p. 17 figs., 4 tables, 27 refs., eqs., biblio., 5 appends. (*See item* 2C–182, March 1952, *MAB.*) **DWB**—A review of the concept of potential evapotranspiration, and a description of instrumentation developed at Seabrook for measuring evapotranspiration, and instructions for making and analyzing the observations

A world wide network of stations, measuring the potential evapotranspiration, is suggested. Tables for easier application of Thornthwaite's formulas are given. *Subject Headings:* 1. **Evapotranspiration 2. Evapotranspirometers. I. Johns Hopkins University. Laboratory of Climatology II. Contract W28-099-ac-378.**—*A.A.*

## CLOUD PHYSICS AND ICING

*See also items:* 4.2–26, Dew measurement (Hofmann); 4.2–55, Measurement of size of water droplets in clouds (Golitzine); 4.2–87, Properties, behavior of air contaminants (Johnstone); 4.2–195, Cloud droplet growth by coalescence (Kriestanov); 4.2–211, Evaporation of droplets falling freely in atmosphere (Kriestanov); 4.2–282, Method of measuring electrical space charge of air (Mühleisen, R. and Holl)

4.2–181 551.574.1:551.578.41

aufm Kampe, Hans Joachim, **Feuchtigkeitsverhältnisse in Cirruswolken und die daraus resultierenden Formen der Eiskristalle.** [Humidity conditions in cirrus clouds and the resulting forms of ice crystals.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:298–302, **1952.** 8 figs., table, 10 refs., 8 eqs. **DWB**—Assuming various plausible concentrations of particles, the growth of ice crystals and the resulting decrease of relative humidity in CiSt are calculated. It is concluded that while CiSt is mostly formed in air slightly under-saturated with respect to water, the tufted crystals of CiCu form in supersaturated air. For regular prisms a humidity of about 110% with respect to ice appears necessary. *Subject Heading:* **1. Snow crystal formation.**—*C.E.P.B.*

4.2–182 551.574.1:551.578.41

aufm Kampe, Hans Joachim; Weickmann, Helmut K. and Kedesdy, H. H.; Kumai, Motoi, **Remarks on "Electron-microscope study of snow-crystal nuclei."** *Journal of Meteorology*, 9(5):374–376, Oct. **1952.** 5 figs., 11 refs. **MH-BH**—Photographs are given of nuclei of cirrus crystals which appear to be combustion products of diameter $10^{-6}$ to $10^{-3}$ cm. They resemble M. KUMAI's snow crystal nuclei and authors consider that minute liquid droplets cannot exist in cloud. KUMAI contests this. *Subject Headings:* **1. Snow crystal formation 2. Condensation nuclei.**—*C.E.P.B.*

4.2–183 551.574.1(794)

Crozier, W. D., Seely, Ben K. (*New Mexico Inst. of Mining and Technology, Socorro, N. Mex.*) and Thompson, A. H. (*Univ. of Calif., Dept. of Meteorology*), **A second chloride cloud in California.** *American Meteorological Society, Bulletin*, 33(4):177–178, April **1952.** 3 refs. **MH-BH**—A report of a chloride cloud observed on Sept. 13 and 14 during airplane flights over the Mojave Desert between Death Valley and the coastal mountains. The cloud was at an elevation of 10,000 ft and its chloride concentration ranged up to $10^4$ particles per $m^3$. Air trajectories led back to the vicinity of a tropical disturbance off Baja California. However, the chloride cloud was not accompanied by an increase in moisture content of the air in its vicinity. It is concluded "that the chlorides were in air primarily from the Pacific high, but with an admixture from the region of the tropical disturbance off Baja California." *Subject Headings:* **1. Cloud structure 2. Chloride clouds 3. California.**—*I.L.D.*

4.2–184 551.574.1

Facy, L., **Forme des microcristaux dans les noyaux de condensation.** [Form of microcrystals in condensation nuclei.] *Journal Scientifique de la Météorologie*, 4(13):9–19, Jan./March **1952.** 4 plates, 14 refs. French, English and Spanish summaries p. 9. **DWB**—By means of electron micrographs of condensation nuclei only a rough idea of the nature of the nuclei can be obtained. Photographs made at Trappes, on Pic du Midi, and at sea (Antibes) of various types of NaCl crystals illustrates many difficulties. The author discusses the various forms observed by means of the electron microscope: lozenge, hexagonal, cubes, cube pyramids, needles, plates, globules, crystalline spheres, amorphous forms and complex forms, and shows that in view of the many types of salts in sea air, and the numerous anomalous and varied forms of each salt, it is not possible to identify condensation nuclei by such means

unless a preponderance of one salt (e.g. NaCl) is present. *Subject Headings:* **1. Condensation nuclei 2. Photomicrographs 3. Electron micrographs 4. Microcrystals.**—*M.R.*

4.2–185 551.574.1

†Grabovskiĭ, R. I., **Mirovoĭ okean kak istochnik atmosfernykh iader kondensatsii.** [The world ocean as a source of condensation nuclei.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofizicheskaia*, 2:56–74, **1952.** 2 figs., 5 tables, 36 eqs. **DLC**—The various hypotheses concerned with the origin of atmospheric condensation nuclei namely the continental, cosmic and marine hypotheses are discussed critically. A thorough analysis is made of the marine hypothesis which attributes the origin of atmospheric condensation nuclei to the action of wind upon the sea surface and the resulting spray formation. An approximate calculation of the annual amount of salt entering the atmosphere from the sea surface is made and the quantity of chlorides removed from the atmosphere in the form of condensation nuclei of precipitation is estimated. Conclusive evidence is presented indicating that spray from sea water plays a fundamental role in the salt balance of the earth and is the source of condensation nuclei. *Subject Headings:* **1. Condensation nuclei 2. Sea spray 3. Chloride content of air.**—*I.L.D.*

4.2–186 551.574.1:551.591.1

Moore, D. J., **Measurements of condensation nuclei over the North Atlantic.** *Royal Meteorological Society, Quarterly Journal*, 78(338):596–602, Oct. **1952.** 4 figs., 4 tables, 16 refs. **DWB**—Counts of condensation nuclei on "Weather Observer" in N. Atlantic (61–59°N, 13–19°W) varied from 77 to 2460/cm², decreasing with increase of vertical mixing as shown by cloud type (St to Cu) and with winds from open ocean but with no relation to wind speed. Large nuclei ($>10^{-11}$g) increased markedly with wind speed and wave height. This accounts for observed increase of opacity with wind speed, wave height and relative humidity (above 80%). *Subject Headings:* **1. Condensation nuclei 2. Saline nuclei 3. Visibility 4. Weather ship "Weather Observer" 5. North Atlantic.**—*C.E.P.B.*

4.2–187 551.574.1:551.576.11

Squires, P. (*Univ. Grounds, Sydney*), **The growth of cloud drops by condensation.** *Australian Journal of Scientific Research, Ser. A, Physical Sciences*, 5(1):59–86, March **1952.** 6 figs., 5 tables, 21 refs. **MH-BH**—It was found previously that clouds contain a narrower range of drop sizes than of condensation nuclei, as a result of supersaturation which increases from zero at base of cloud to a maximum not far above, so that a nucleus grows rapidly to a size at which the nucleus exerts little effect on the drop's growth. In this paper the effect of ventilation on drop growth due to falling velocity is formulated. Transfer of heat and water vapor, heat balance of a drop, equation of growth, growth in cloud under adiabatic assumption, characteristics of condensation processes in a cloud, approximate value for supersaturation, relative magnitude of lag term which is neglected, growth of small droplets, growth of large droplets and finally definition of $M$, the measure of nucleus size for small nuclei are discussed in quantitative terms. *Subject Headings:* **1. Drop growth 2. Cloud physics 3. Condensation nuclei.**—*M.R.*

4.2–188 551.574.7:629.135

Best, A. C., **Occurrence of high rates of ice accretion on aircraft.** *Great Britain. Meteorological Office, Professional Notes*, No. 106, **1952.** 22 p. 4 figs., 9 tables, 14 refs., 16 eqs. At head of title: M.O. 524f. **DWB**—Measurements of liquid-water content and effective drop diameter by A. R. Jones and W. Lewis in America are tabulated. The collection efficiency of different parts of an aircraft is related to the theoretical values on a cylinder and to observations, and good agreement found. Methods of calculating liquid-water content in convective and layer type clouds are discussed and results compared with observation. From these the percentage frequencies of icing rates in convective clouds are calculated in terms of air speed, water content and effective drop size and extrapolated to conditions in low latitudes (cloud base at 76°F). From the temperature of spontaneous freezing of drops of a given diameter and the drop-size distribution, the liquid fractions in clouds of different temperatures and drop

sizes are calculated and a numerical icing scale determined. *Subject Headings:* **1. Icing of aircraft 2. Water content of clouds.**—*C.E.P.B.*

4.2–189 551.574.7:629.135

Frith, R.; Mason, B. J., **The icing of aircraft at temperatures below −41°C.** *Royal Meteorological Society, Quarterly Journal*, 78(336):273–274, April, 1952. ref. **DWB**—Frith criticizes report by Mason of icing on wing of Mosquito at −41°C as mistaken. Mason replies. *Subject Heading:* **1. Icing of aircraft.**—*C.E.P.B.*

4.2–190 551.574.7:629.135

Hacker, Paul T. and Dorsch, Robert G., **A summary of meteorological conditions associated with aircraft icing and a proposed method of selecting design criterions for ice-protection equipment.** *U. S. NACA, Technical Note*, 2569, Nov. 1951. **DWB**—Data on the meteorological parameters pertinent to the aircraft icing problem are so summarized as to give the frequency of occurrence of observed icing situations according to two of the parameters. The summarized data indicate that statistical relations exist between some of the parameters. A method, based upon the collection efficiency of an airfoil and the frequency of occurrence of icing situations with various liquid-water contents and mean-effective droplet sizes, is proposed for the selection of design criterions for ice-protection equipment. The method provides a convenient means of calculating the percentage of icing encounters in which the water collection rate exceeds the design rate. *Subject Headings:* **1. Icing of aircraft 2. Icing research 3. Icing prevention.**—*Authors' abstract.*

## FOG

*See also items:* 4.2–54, Fog (Brun, Demon, Vasseur and Caron); 4.2–93, Smog (Zarem and Rand)

4.2–191 551.575 551.576 551.582:629.13(411)

Davis, N. E., **Fog and low stratus at Prestwick airport, with notes on the diurnal variation of surface wind and temperature.** *Meteorological Magazine*, London, 81(962):231–239, Aug. 1952. 2 figs., 5 tables, 2 refs. **DWB**—At Prestwick (Scotland) fog occurs for only 0.3% of the time, mainly March and June through Aug. Summer fogs are mostly radiation fogs in early morning; winter fogs are advective. Low cloud is a greater hazard especially in summer and autumn, 2 hr after sunrise and at sunset. Diurnal variation of surface wind and temperature is also discussed. Detailed frequency curves are given. *Subject Headings:* **1. Airport landing conditions 2. Fog frequencies 3. Stratus clouds 4. Prestwick, Scotland.**—*C.E.P.B.*

4.2–192 551.575:598.2

Lincoln, Frederick C., **Do birds fly in zero-zero weather?** *U. S. Air Services*, Wash., D. C., 36(12):25, Dec. 1951. **DLC**—It has been found that birds can fly a true compass course in dense fog, can pinpoint an island so far at sea that only the most careful marine navigation could locate it, and that homing pigeons and migratory birds seem to be thrown off course in the vicinity of broadcasting stations or radar fields. *Subject Headings:* **1. Aerial navigation 2. Bird navigation 3. Fog.**—*M.R.*

4.2–193 551.575.2:551.575.36(43)

*Germany. Meteorologisches Amt für Nordwestdeutschland, **Die Nebelverhältnisse der Unterelbe im Jahrezehnt 1939–1948.** [Fog conditions in the lower Elbe in the decade 1939–1948.] March, 1952. 8+p. 6 figs., 8 tables, diagr. **DWB**—Fog was reported when objects at distance of 1000 m could no longer be recognized clearly. Statistical data (tabular and graphical) are given on the mean annual and monthly number of fog days, mean number of hours of fog during the year for each month and per day; mean annual and monthly duration of fog; the maximum and minimum hours with fog for each observation station; monthly number of hours without fog at each station; months with much fog and with little fog on the Lower Elbe region; individual fogs of long duration; and daily variation of fog frequency

at each station. The observation stations are shown on a map. *Subject Headings:* **1. Fog distribution 2. Fog frequencies 3. Elbe Region, Germany. I. Hartenstein, Dr. II. Markgraf, Hans.**—*I.L.D.*

## CLOUDS

*See also items:* 4.2–1, Experimental cloud formation (Brunt); 4.2–137, Zenithal sky light and atmospheric processes (Hartmann); 4.2–178, Hill-wave cirrus (Ludlam); 4.2–187, Growth of cloud drops by condensation (Squires); 4.2–191, Fog and low stratus, Prestwick airport (Davis); 4.2–199, Production of showers by growth of ice particles (Ludlam)

4.2–194 551.576.1:778

Miura, Taketugu, **A geometrical optics of whole sky projection.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 30(3):112–117, March **1952.** 3 figs., 3 refs., eqs. In Japanese, English summary p. 112. **MH-BH**—The optical theory of mirrors for whole sky projection is described with special reference to a new stereographic mirror for distributionless projection. *Subject Headings:* **1. Cloud observations 2. Stereographic photography 3. Whole sky photography.**—*A.A.*

4.2–195 551.576.11:551.574.1

Kriestanov, L., **Vierkhu edin sluchaĭ na ugolemiavane na oblachni kapki chrez slivane.** [Growth of cloud droplets by coalescence.] *Biuelgarska Akademiia na Naukite, Sofia, Izvestiia, Seriia Fizicheska*, 1:196–201, Jan./Dec. **1950.** 5 refs., 14 eqs. In Bulgarian, Russian and English summaries p. 202–203. **DLC**—The mechanism of growth of relatively large water droplets coalescing with smaller droplets while falling in a cloud has been examined on the basis of the dynamical equations of MESTERSKI for a body with changing (increasing) mass. The resistance of the air has been accounted for in its most general form as dependent on the drag coefficient $C$. For $C=$ const. the differential equation for the movement can be integrated exactly and the relation between the velocity, the radius of the droplet and the time is thus obtained. For relatively large droplets we receive:

$$v^2=\frac{8g\rho w}{7e+3ce}R$$

where $v$ is the velocity, $R$ the radius, $g$—gravity, $\rho w$ and $\rho$ the densities of the droplet and the air, $e$—the water content of the cloud. The time needed for a droplet to grow from $R_0$ to $R$ is given by

$$t=\frac{4\rho w\sqrt{7e+3c\rho}}{e\sqrt{29\rho w}}(\sqrt{R}-\sqrt{R_0}).$$

*Subject Headings:* **1. Drop accretion 2. Coalescence 3. Drop velocities 4. Drop size distribution.**—*Author's abstract.*

4.2–196 551.576.11:551.558.21

Ludlam, Frank Henry, **Orographic cirrus clouds.** *Royal Meteorological Society, Quarterly Journal*, 78(338):554–562, Oct. **1952.** 5 figs., 2 plates, table, 7 refs. **DWB**—Physics of formation of lenticular cirrus is discussed. Observations of cirrus formation to lee of hills about 1000 ft high W of Dunstable, England, are described with map, sketches and photos, and discussed in relation to upper air data. Diurnal variation of cirrus (minimum midday) is explained by reduction of orographic wave disturbance. *Subject Headings:* **1. Cirrus clouds 2. Lee effects 3. Dunstable, England.**—*C.E.P.B.*

4.2–197 551.576.11

Malkus, Joanne Starr, **The slopes of cumulus clouds in relation to external wind shear.** *Royal Meteorological Society, Quarterly Journal*, 78(338):530–542, Oct. **1952.** 10 figs., table, 11 refs., 15 eqs. **DWB**—The slope of a cumulus cloud dèpends on the vertical velocity within the cloud, the external wind shear coupled with the degree of entrainment, and the inertia of

the cloud (form drag). These are analyzed, the form drag being equated to a comparable cylinder, and an expression for the cloud slope is derived, and evaluated for various cases. This equation is applied to trade cumulus E of Puerto Rico, and 3 cu clouds over Nantucket Island. Comparison with observed slant shows that considerable entrainment occurs, of the magnitude calculated by STOMMEL (1947). *Subject Headings:* **1. Cloud structure 2. Cumulus cloud formation.**—*C.E.P.B.*

4.2–198 551.576.2(438)

Koebcke, Fryderyk, **Zachmurzenie nocnego nieba w Poznaniu.** [The cloudiness of the night sky in Poznań.] *Przegląd Meteorologiczny i Hydrologiczny*, Warsaw, v. 1950–1951:111–116, **1952.** 5 tables. **DWB**—Results of observations, executed systematically in the Astronomical Observatory of the University in Poznań, on the cloudiness of the night sky. Table I indicates mean values of this phenomenon for the individual months, and also the annual averages. In table II, clear nights are given, while in table III the nights with cloudiness are shown. Table IV indicates the frequency of two, three etc. consecutive clear or cloudy nights, appearing in the observation-period (Nov. 1926 to Sept. 1939). They are compared separately for the nights with cloudiness and for the clear nights. In table V such frequency is given in percentage, depending on the month. *Subject Headings:* **1. Nocturnal cloudiness 2. Cloud frequencies 3. Poznań, Poland.**—*Wanda Tomczykowski.*

## PRECIPITATION

*See also items:* 4.2–29, Instruction for precipitation measurement, German Democratic Republic; 4.2–32, Precipitation, cause of radar upper bands (Browne); 4.2–39, Meteorological statistics—precipitation (Nakamura); 4.2–61, Onset of monsoon, Dehli (Bhullar); 4.2–142, Correlation between winter temperature anomalies and precipitation in N. Hemisphere (Krames); 4.2–166, Synoptic aspects of monsoon circulation and Rainfall, Indo-Pakistan (Rahmatullah); 4.2–219, Water economy of Mediterranean compared with Baltic Sea (Wüst); 4.2–245, Rainfall distribution under apple tree during vegetative period (Linskens); 4.2–252, Indian climostatics (Chatterjee); 4.2–267, Influence of altitude on temperature and precipitation (Buchinskiĭ); 4.2–269, Persistence and recurrence of weather in mid-autumn (von Rudloff)

4.2–199 551.577.11:551.576.11:551.574.1

Ludlam, Frank Henry, **The production of showers by the growth of ice particles.** *Royal Meteorological Society, Quarterly Journal*, 78(338):543–553, Oct. **1952.** 6 figs., 18 refs., eq. **DWB**—Cu clouds are regarded as containing successive rising bubbles of air about 1 km across with well defined upper surfaces but extensive wakes with entrainment. At the top they sink aside and evaporate. The mechanism of growth of nuclei in successive bubbles into raindrops or hailstones is discussed with numerical estimates. An expression for growth of ice particles is evaluated for different radii and temperatures; coagulation exceeds condensation over most of the growth of the precipitation element. Showers should appear with summit temperatures −10°C in summer, −20°C in winter. Observations are in general agreement with this. Relation of features determining shower formation in cu is shown schematically. *Subject Headings:* **1. Precipitation formation 2. Ice nuclei.**—*C.E.P.B.*

4.2–200 551.577.21(969)

Stidd, C. K. and Leopold, Luna B., **The geographic distribution of average monthly rainfall, Hawaii.** *Meteorological Monographs*, Boston, 1(3):24–33, June **1951.** 7 figs., table, 10 refs. **MH-BH**—A detailed study of the geographic effect in rainfall distribution. The relation of individual areas to the island as a whole is examined. Month-to-month and island-to-island comparisons are made. A method is suggested for forecasting the rainfall distribution on the island. *Subject Headings:* **1. Rainfall distribution 2. Hawaii.**—*A.A.*

4.2–201 551.577.3:551.506.3(969)

Landsberg, Helmut (*Boston, Mass.*), **Statistical investigations into the climatology of rainfall on Oahu (T.H.).** *Meteorological Monographs*, Boston, 1(3):7–23, June, **1951.** 11 figs., 8 tables, 8 refs. **MH-BH**—A carefully homogenized rainfall series for Honolulu is given

(1874–1945). The stability of medians is found higher than the stability of means. The frequency distribution and its asymmetry is examined. In all cases of marked departures of rainfall from the normal the whole island is uniformly affected. The standard deviation is calculated and compared with the interannual variability. High correlations between the annual precipitation on the windward and lee shores are found. A few relationships of precipitation to pressure and synoptic pattern are given. *Subject Headings:* **1. Rainfall variations 2. Long period records 3. Statistical analysis 4. Oahu, Hawaii.**—*A.A.*

4.2–202 551.577.36

*Bogomazova, Z. P. and Petrova, Z. P., **Kharakteristika vydaiushchikhsia dozhdeĭ na territorii tsentral'nykh chernozemnykh oblasteĭ.** [Characteristic features of outstanding rains in the territory of the central chernozem districts.] *Leningrad, Gosudarstvennyĭ Gidrologicheskiĭ Institut, Trudy*, No. 14(68):95–122, **1949.** 12 figs., 16 tables, 9 refs., append. **DLC**—A statistical investigation, showing the frequency of rains according to rainfall amount and duration. Charts for maximum rainfall, soil erosion and isohyets for single rains are presented. N. A. SHIRKOVA wrote one chapter of the paper, explaining the synoptic conditions for the origin of the outstanding rains. The rainfall runoff and the intensity distribution during the time is discussed. The approach of the authors is purely phenomenological; no mathematical relationships or clear results are given. The appendix comprises a good data source for rainfall frequencies. *Subject Headings:* **1. Rainfall frequencies 2. Runoff 3. U.S.S.R. I. Shirkova, N. A.**—*A.A.*

4.2–203 551.577.37

Chapman, William T. and Carr, J. A. (*U. S. Weather Bureau, Wash., D. C.*), **Heavy rainfall over northeastern Wyoming and southern Montana, May 21, 1952.** *Monthly Weather Review*, 80(5):88–93, May **1952.** 15 figs. **MH-BH**—Synoptic analysis (surface and upper air) of situation which resulted in 1 to 3 inches of rain in a large area of southeastern Montana, eastern Wyoming and Nebraska. Moisture supply came from the Gulf of Mexico, but most of the rain was post-frontal. *Subject Headings:* **1. Rainstorms 2. Synoptic studies 3. Wyoming 4. Montana.**—*M.R.*

4.2–204 551.577.37

Chomicz, Kazimierz, **W sprawie jednolitej skali dla klasyfikacji deszczów o duzym natężeniu.** [On a uniform scale for classification of heavy rains.] *Przegląd Meteorologiczny i Hydrologiczny*, Warsaw, v. 1950–1951:42–56, **1951.** 5 figs., table, eqs. English summary p. 56. **DWB**—A new uniform scale for showers and heavy rains is introduced. The starting point is the prerequisite that maximum rainfall recorded anywhere in the world should be distributed along the curve of the scale. The formulas and tables determining the connection between the amount of rainfall and its duration have a local character although they have a similar course everywhere. *Subject Headings:* **1. Excessive rainfall 2. Maximum rainfall 3. Rainfall depth duration studies.**—*A.M.P.*

4.2–205 551.577.38:551.588.6

Fedorov, E. E. and Chubukov, L. A., **Formirovanie zasushlivykh pogod i puti ikh vozmozhnogo preobrazovaniia.** [Origin of drought weather and possibilities of its modification.] *Problemy Fizicheskoĭ Geografii*, 16:16–31, **1951.** 16 figs., 11 refs. **DLC**—The types of drought weather, which occur in the European part of the U.S.S.R., are described in terms of Fedorov-Chubukov scheme of "complex climatology"; the radiational balance of this area during the summer months, the air mass characteristics and the geographical factors producing drought conditions are discussed. The possible effect of the planned afforestation in altering the climate of this area and the ways by which this effect can be achieved are analyzed. *Subject Headings:* **1. Drought prevention 2. Forest influences 3. European U.S.S.R.**—*I.L.D.*

4.2–206 551.577.38(54)

Sarma, V. Vittal (*Met. Off. N. Delhi*), **An analysis of the rainless days of Delhi.** *Indian Journal of Meteorology and Geophysics*, Delhi, 3(1):17–24, Jan. **1952.** 3 figs., 7 tables, 2 refs. **DWB**—Defining a rainless day as one when no rain was recorded or the rainfall recorded was

cm or less, the occurrence of all the rainless days and rainless spells at Delhi during the period 1876–1931 have been listed. Relevant tables giving means, standard deviation and extreme number of rainless days for different months and the frequencies of rainless spells of different duration have been derived. The probability of a day falling in a rainless spell of specified duration has also been worked out. *Subject Headings:* **1. Drought frequencies 2. New Delhi, India.**—*Author's abstract.*

4.2–207 551.577.51

Yoshida, S., **Relation between rainfall and altitude on Mt. Iwate.** *Journal of Meteorological Research*, Tokyo, 3(10):364–367, July **1951.** 4 figs., eqs. In Japanese, English summary p. (21–22). **MH-BH**—Observations of two months only are used to investigate the relation between rainfall and altitude. No certain results are obtained. The influence of wind on the measurements by the ordinary raingage is discussed. *Subject Headings:* **1. Altitudinal influences 2. Rainfall 3. Mt. Iwate, Japan.**—*A.A.*

4.2–208 551.577.59:551.556

Kreutz, Wilhelm, **Niederschlagsmessungen in verschiedenen Höhen über dem Erdboden unter Berücksichtigung der Windverhältnisse.** [Rainfall measurements in different heights above the ground with regard to wind conditions.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:182–185, **1952.** 4 figs., 8 tables. **DWB**—Observations at Giessen (1946–51) at 0, 1 and 14 m above ground are tabulated according to wind direction and force. The decrease with height from values at 0 was 7.3% at 1 m and 21.5% at 14 m; values at height $x$ are given by $9.8e^{-x}-(0.41+0.18w)x+90.2$, $w$ = wind force (Beaufort). *Subject Headings:* **1. Precipitation measurements 2. Wind effects.**—*C.E.P.B.*

4.2–209 551.578.11:016:019.941

†Great Britain. Dept. of Scientific and Industrial Research. Fuel Research, **The composition of rain water bibliography.** East Greenwich, Fuel Research Station, **1952.** 7 p. Typescript. **GB-MO**—Abstracts are given of 33 papers issued between 1924 and 1947 in various parts of the world (all titles in English), including notes of the amounts and composition of dissolved impurities, methods of measurement, etc. *Subject Headings:* **1. Rain composition 2. Bibliographies.**—*C.E.P.B.*

4.2–210 551.578.11

Green, Robert L. (*Louisiana State Univ.*), **Evaluation of air resistance to freely falling drops of water.** *Agricultural Engineering*, St. Joseph, Mich., 33(1):28, Jan. **1952.** fig., table, 2 eqs. **DLC**—A basic formula for determining air resistance to a falling drop as a function of drop diameter is presented and applied in tabular and graphical form to various drop diameters from 1.17 to 3.92 mm. *Subject Headings:* **1. Air resistance 2. Drop growth.**—*G.T.*

4.2–211 551.578.11:551.574.1:551.558.1

Kriestanov, L., **Vierkhu izpariavaneto na svobodno padashchi vodni kapki v atmosferata.** [On the evaporation of droplets falling freely in the atmosphere.] *Bulgarska Akademiia na Naukite, Izvestiia, Seriia Fizicheska*, 1:204–210, Jan.–Dec. **1950.** 3 refs., 24 eqs. In Bulgarian, Russian summary p. 209, English summary p. 210. **DLC**—The dynamical equations of MESTERSKI for a body with changing (decreasing) mass have been employed in order to determine the relation between the velocity, radius and time for a falling droplet evaporating continuously. The influence of the air stream on the evaporation has been accounted for by the Leibenson's factor $f$. For $f$ = const. for definite intervals of the values of $r$ or $v$ we obtain the following relation between $v$, $r$ and $h$, $r$:

1. For a droplet falling in still air:

$$v=\frac{2\rho wg}{9\eta+2D\Delta Ef}r^2$$

$$h=\frac{\rho^2 wg(r_0 4-r^4)}{2D\Delta Ef(9\eta+2D\Delta Ef)}$$

2. For a droplet falling in an air stream moving upward with constant velocity:

$$v=\frac{2\rho wg}{9\eta+2D\Delta Ef}r^2-\frac{9\eta-6D\Delta Ef}{9\eta+6D\Delta Ef}w$$

$$h=\frac{\rho w^2(r_0^4-r^4)}{2(9\eta+2D\Delta Ef)D\Delta Ef}-\frac{(9\eta-6D\Delta Ef)\rho w^2}{2(9\eta+6D\Delta Ef)D\Delta Ef}(r_0^2-r^2)$$

Here $\eta$ is the viscosity of the air, $D$ the diffusion coefficient of water vapor in air, $\Delta E$ the humidity deficiency. *Subject Headings:* **1. Drop evaporation 2. Drop velocities 3. Drop size distribution 4. Vertical velocity.**—*Author's abstract.*

## SNOW

*See also items:* 4.2–35, Radar measurement of snow parameters (Marshall and Gunn); 4.2–181, Humidity in cirrus and resulting ice crystal forms (aufm Kampe); 4.2–182, Electron microscope study of snow crystal nuclei (aufm Kampe, Weickmann. . . .)

4.2–212 551.578.4(569.4)

Shalem, N. (*Hebrew Univ., Jerusalem*), **La neige en Palestine en février 1950.** [Snow in Palestine in Feb. 1950.] *La Météorologie*, 4th Ser., No. 22:135–138, April–June **1950.** photo. French, English and Spanish summaries p. 135. **DWB**—Because most of the precipitation in Palestine occurs in the cold season, the high mountains are usually covered with snow for periods of varying length each year. The valley of the Jordan and the coastal plain are known to be almost snowless, but several times in the past century, as on this occasion in February 1950, heavy snow fell in the lowlands. In the time of David and other times throughout history similar snows are mentioned. In 1885 it was 2 feet deep in Jerusalem. This time it was 16 in. deep and the temperature −6°C at Jerusalem. Details and extent of snow are presented; good photographs included. *Subject Headings:* **1. Snowfall frequencies 2. Palestine.**—*M.R.*

4.2–213 551.578.41

Obenland, E., **Über den Schneeanteil am Niederschlag.** [On the proportion of snow in precipitation.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:167–171, **1952.** 4 tables, 5 refs. **DWB**—A new method of determining the proportion of precipitation which falls as snow is described, using measurements of new snow on a snowboard. Values are given for Oberstdorf 1936/7–1950/51. *Subject Headings:* **1. Snow analysis 2. Oberstdorf, Germany.**—*C.E.P.B.*

4.2–214 551.578.45

Andrus, C. C. (*U. S. Weather Bureau, Cleveland, Ohio*), **On the storm of November 1950.** *American Meteorological Society, Bulletin*, 32(10):391–392, December, **1951. DWB**—The author believes that the great storm of late November 1950 did not receive all the attention it would have merited on account of "its history, its highly curved course and its violence in way of wind, snow and cold" and the fact that it occurred within a dense network of observation stations. The value which the publication of a detailed study of this storm would represent both for theoreticians and for practical meteorologists, in the author's opinion, would justify every possible encouragement and aid from the part of members of the AMS. *Subject Headings:* **1. Severe snowstorms 2. Ohio.**—*G.T.*

4.2–215 551.578.46:551.583.14

*Brose, Karl, **Über Schneeverhältnisse der letzten 50 bis 60 Jahre im mittleren und südlichen Westdeutschland.** [On snow conditions of the last 50–60 years in central and southern West Germany.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:171–177, **1952.** 3 figs., 5 tables, 8 refs. **DWB**—Diagrams and tables are given of number of days with snow cover and greatest snow depths. Values decreased from 1890–1920 or 1930, then increased. Greatest depths occurred in 1941/2 and 1940/1. *Subject Headings:* **1. Snow cover 2. Germany.**—*C.E.P.B.*

## HYDROMETEOROLOGY

*See also items:* 4.2–62, Flood forecast in snow melting period, Japan (Daidoji and Suziki); 4.2–64, Correlation calculation, application to hydrology (Bogárdi)

4.2–216 551.579:519.241.8

Chow, Ven Te, **A general formula for hydrologic frequency analysis.** *American Geophysical Union, Transactions*, 32(2):231–237, April **1951.** 9 figs., 9 refs., 15 eqs. Discussion by E. J. Gumbel and reply by author, *ibid.*, 33(2):277–282, April **1952.** 2 figs., 7 refs. **MH-BH**—The author develops a general formula for hydrologic frequency analysis. The frequency factor is verified by the methods of FULLER, HAZEN, FOSTER, SLADE, GUMBEL and POTTER and it is found that the difference among the methods is due to varying definitions of the frequency factor. The procedure of hydrologic frequency analysis is outlined. In the discussion PROF. E. J. GUMBEL examines critically CHOW's comparison of the different distributions used in hydrology, namely the logarithmically normal distribution (HAZEN's method), and POTTER's method. VEN TE CHOW presents a theoretical analysis of the use of the logarithmically normal distribution in statistical analysis and explains the discrepancy between the results of POTTER's study and the theory of extreme values for large values of the coefficient of variation. *Subject Headings:* **1. Hydrology 2. Frequency distribution 3. Statistical analysis. I. Gumbel, E. J.**—*I.L.D.*

4.2–217 551.579:551.508.7:551.579.5

*†Harrold, Loyd Larren and Dreibelbis, F. R., **Agricultural hydrology as evaluated by monolith lysimeters.** *U. S. Dept. of Agriculture, Technical Bulletin*, No. 1050, Dec. **1951.** 149 p. 42 figs., 33 tables, 51 refs., appends. Price 45¢. **DWB**—A progress report on the lysimeter investigations carried on at the North Appalachian Experimental Watershed near Coshocton, Ohio. Eleven monolith lysimeters were used. The large amount of moisture condensed and absorbed from the atmosphere (annually over 150 mm, about 23% of the precipitation) is an important factor in the water balance. About 80% of the soil moisture depletion was due to evapotranspiration. Results for different crops were obtained, and special attention was given to the diurnal course of evapotranspiration and absorption. Owing to the usually disregarded condensation, absorption and the common systematic errors in precipitation measurements, the actual evapotranspiration is probably 50% higher than the water loss calculated by the difference in precipitation minus runoff. The work contains a selected bibliography on lysimeter investigation. *Subject Headings:* **1. Agricultural hydrology 2. Hydrologic cycle 3. Lysimeters 4. Coshocton, Ohio.**—*A.A.*

4.2–218 551.579.2

Gurevich, M. I., **Protsessy peremeshcheniia talykh vod v snezhnom pokrove i vodootdacha iz snega.** [Processes of transport of melt water through the snow cover and the water yield from snow.] *Leningrad. Gosudarstvennyĭ Gidrologicheskiĭ Institut, Trudy*, No. 14(68):177–217, **1949.** 13 figs., 6 tables, 12 refs., 11 eqs., append. **DLC**—Investigations were taken up for computing the runoff from melting snow. Due to water accumulation in the snow cover the water yield is different from the amount of melted snow. The runoff was measured from a small area (11 m²). A very detailed description of the observations is given and the results are summarized. The author distinguishes the accumulation phase and the runoff phase. The beginning of the second phase can be determined by $m_k = 0.0075\ m_0^{\frac{3}{4}}$; $m_k$—critical water content of the snow cover in mm, when further accumulation is impossible and runoff begins; $m_0$—the equivalent water content before the melting process. *Subject Headings:* **1. Snow melt 2. Runoff 3. Water content of snow.**—*A.A.*

4.2–219 551.579.4:551.573:531.577.3(262)

Wüst, Georg (*Dir. Inst. Meereskunde der Univ. Kiel, Germany*), **Der Wasserhaushalt des Mittelländischen Meeres und der Ostsee in vergleichender Betrachtung.** [Water balance of the Mediterranean compared with that of the Baltic Sea.] *Geofisica Pura e Applicata*, 21:7–18, **1952.** 5 figs., refs. German and English summaries p. 7–8. **MH-BH**—An understanding of the water balance of oceans and seas is basic to marine meteorology. With this in

mind, the author studies and compares, inflow, evaporation, precipitation, runoff and othe factors affecting the balance in the Baltic and Mediterranean seas. Hydrographic an climatic effects of damming up the straits are considered. *Subject Headings:* **1. Marine meteorology 2. Ocean water balance 3. Baltic Sea 4. Mediterranean Sea.**—*M.P.K.*

4.2–220 551.579.5:63

Baumann, Hans (*Humbold-Univ., Berlin*), **Die Bodenfeuchtebestimmungen und ihre Auswertung für die Landwirtschaft.** [Determinations of soil moisture and their evaluation for agricultural purposes.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte* No. 32:4–8, **1952.** 10 figs. **DWB**—No definite correlation can be found between soil moisture and yield. It seems that a steady water supply is the optimum condition for plants. Extended droughts and rain periods decrease the yield. It is suggested that maximum water capacity and the wilting point be determined by direct long period observations. *Subject Headings:* **1. Agricultural meteorology 2. Soil moisture.**—*A.A.*

4.2–221 551.579.5:537.2

Cownie, A. and Palmer, L. S., **The effect of moisture on the electrical properties of soil.** *Physical Society of London, Proceedings*, B65:295–301, **1952.** 3 figs., 11 refs., eqs. **DWB**—Dielectric constants of a clay soil at humidities 4.1–47.7% of dry clay were measured at a frequency of 430 Mc/s and compared with earlier results. The setup is described and theory given. Dielectric constant varied from 4.0–31.4. A point of inflection at 15–20% may be due to change from "bound" to free water. Conductivity varied roughly from $1.5\times10^9$ e.s.u. at 4% to $4\times10^{10}$ at 50%. *Subject Heading:* **1. Soil moisture.**—*C.E.P.B.*

4.2–222 551.579.5

Kostychev, P. A., **O bor'be s zasukhami v chernozemnoĭ oblasti posredstvom obrabotki poleĭ i nakopleniia na nikh snega.** [The struggle against droughts in the chernozem regions by field cultivation and snow conservation.] (In: Akademiia Nauk SSSR. Institut Fiziologii Rasteniĭ im. KA. Timiriazeva, **Klassiki russkoĭ agronomii v bor'be s zasukhoĭ.** [Classics of Russian agronomy in their fight against drought.] Moscow, **1951.** p. 171–236. tables.) **DLC**—The individual chapters constitute lectures delivered by the author in 1892. They are "Preliminary considerations on some properties of chernozem, etc. and seasonal moisture regime"; "Types of soil water that are useful and useless for plants; means for accumulating snow on fields"; "Various characteristics of chernozem during cultivation and their significance; the characteristics of chernozem upon which the drying out of the soil depends during plant growth, etc." *Subject Headings:* **1. Soil moisture 2. Drought prevention.**—*I.L.D.*

# CLIMATOLOGY AND BIOCLIMATOLOGY

## CLIMATOLOGY

*See also items:* **4.2–4,** Climatic atlas, Bavaria; **4.2–6,** Climatological atlas, British Isles; **4.2–41,** Monthly weather summary, France; **4.2–191,** Fog, low stratus, diurnal surface wind and temperature variation, Prestwick airport (Davis); **4.2–260,** Acclimatization of man in tropical regions (Moniak)

4.2–223 551.58:621.31:06

Spencer, Robin E. (*U. S. Weather Bur., Wash., D. C.*), **Science of climatology can do more for electric utilities.** *Electric Light and Power*, Chicago, 29(5):72, 77–78, May **1951.** photos. diagr. Domestic price .35 per copy; foreign .50. **DLC**—A brief survey of the services that the climatology section of the U. S. Weather Bureau in Washington, D. C. can render to industry. An example is cited which might apply to construction of power installations. The basic analytical data can be furnished at cost by the Weather Bureau. The interpretation in terms usable by the particular industry could be made by Weather Bureau climatologists but is more properly the function of the private meteorological consultant. A "flow chart" shows the organization, functions and services of the U. S. Weather Bureau. *Subject Headings:* **1. Applied climatology 2. Meteorological services 3. U. S. Weather Bureau.**—*M.R.*

4.2–224 551.581:69(6)(213)

Atkinson, Anthony G., **Building research and the problems of building in tropical Africa.** (In: **African Regional Scientific Conference, Johannesburg, Oct. 17–28, 1949,** 2:367–371, 1950. In English; French summary, p. 367–368.) **DWB**—Ways in which weather and climate affect materials in the tropics, and problems of human comfort and health are outlined and means by which science can help improve conditions suggested. *Subject Headings:* **1. Building construction 2. Tropical climatology 3. Africa.**—*M.R.*

4.2–225 551.581:551.586:572

†Bates, Marston, **Where winter never comes.** New York, Charles Scribner's Sons, **1952.** 310 p. figs., bibliog. p. 287–297. **DLC**—This popular study of the human ecology of the tropics contains a discussion of the effect of tropical climate upon physiological heat regulation, the relationship between climate and civilization, climate and work, adaptation to climate and the role of climate in the human welfare of tropical regions. *Subject Headings:* **1. Tropical climatology 2. Human ecology.**—*I.L.D.*

4.2–226 551.581

Gentilli, J., **A geography of climate.** University of Western Australia, **1952.** 107 p. 17 figs., 38 maps, numerous tables, biblio. **DWB**—An elementary descriptive presentation of climatology and of the geographical distribution of macroclimates. The physical properties of the individual climatic variables are discussed and the geographical disturbances and annual variation are described and illustrated with numerous diagrams and maps. The climates of the world are described and explained by means of the atmospheric circulation. Brief summaries of the various climatic classification results are presented. *Subject Headings:* **1. Geographical climatology 2. Global climate 3. Climatic classifications.**—*I.L.D.*

4.2–227 551.581:551.584.1

KHromov, Sergeĭ Petrovich, **O prichinakh i faktorakh klimata.** [Causes and factors of climate.] *Vsesoiuznoe Geograficheskoe Obshchestvo, Izvestiia,* 83(6):632–635, Nov.–Dec. **1951.** 6 refs. **DLC**—In discussions of the genesis of climate there prevails a confusion between physical processes and geographical factors. The physical factors are income and outgo of radiant energy, which is primary, and the moisture cycle and the general circulation, which are secondary. The geographical factors are latitude, underlying surfaces (including relief distribution of land and water), and height above sea level. The interaction of the physical processes and their modification by geographical factors are discussed. The inadequacies of the current distinction between macroclimate, local climate and microclimate as proposed by S. A. SAPOZHNIKOVA are analyzed. The author proposes the use of the term landscape climate for local climate and for microclimate—climatic differences within a landscape climate. *Subject Headings:* **1. Climatology 2. Microclimatology 3. Geographical climatology.**—*I.L.D.*

4.2–228 551.581:551.588.7

von Schelling, Hermann, **A mathematical climate curve outside the tropics.** *U. S. Medical Research Laboratory, New London, Conn., MRL Report,* No. 183, v. 10, p. 186–207, **1951.** 6 figs., table, 8 refs. **DWB**—A hypothetical mathematical model of the earth, showing three spherical climatic zones in the Northern Hemisphere and three in the Southern (clustered around the poles), and 6 similar rosettes in the temperate zones, plus the tropical zone. The model is based on work of author entitled "Most frequent particle paths on the unit sphere" (*American Geophysical Union, Transactions,* 32(3), 1951). Since there is no homogeneity of temperature or rainfall within each zone, the model is purported to apply to turbulent wind conditions, and to "crops, density of settlement, history, social structure, migrations," etc. *Subject Headings:* **1. Climatic zones 2. Human ecology.**—*M.R.*

4.2–229 551.582:63(54, 61)

Bhatty, Maqbool Ahmad, **The comparative agricultural geography of Barbary (French North Africa) and the Punjab (P) with special reference to their common problem.** *Pakistan Geographical Review,* Lahore, 5(2):28–39, **1950.** 2 maps; 6(2):31–40, **1951.** graphs, maps, refs. **DLC**—Both regions are characterized by a transition from humid and subhumid condi-

tions in the north through a broad semi-arid belt to desert conditions in the south and they have a marked rainfall periodicity but at opposite seasons. Periodic drought, insufficient total rainfall combined with high temperature, and high evaporation constitute the principle hazards to agriculture. A detailed comparative analysis of the climates in the two areas is presented. Maps of seasonal rainfall and aridity (de Martonne index) for Barbary and Punjab are presented. *Subject Headings:* **1. Agricultural meteorology 2. Climatic analogs 3. Barbary, North Africa 4. Punjab, India.**—*I.L.D.*

4.2–230 551.582:636(79)

Hays, John C. (*Modoc County Farm Advisor*), **Relation of climate to agriculture in Modoc County, California.** Alturas, Calif., Modoc County Agricultural Extension Service, Dec. **1951.** 6 p. 3 figs., 7 refs. **DWB**—In this brief circular intended for the cattle and sheep-herders of Modoc County, a general description of the 4,000-square-mile area is offered. The territory is situated in the northeast corner of California with valleys at altitudes from 4,200 to 5,000 ft and peaks over 9,500 ft. Its climate is characterized by dry summers and cold wet or cold dry winters, with 70% of the annual precipitation occurring from Nov. to May. Data on killing frost in the growing season, on high, average and low temperature and on seasonal distribution of precipitation are presented and the effects of climatic factors on agriculture and cattle and sheep raising discussed. *Subject Headings:* **1. Climate of California 2. Agricultural climatology 3. Animal husbandry 4. Modoc County, Calif.**—*G.T.*

4.2–231 551.582(269)

*Kawamura, Shiro; Tsubata, Fumitaka; Taguchi, Ryuzo; Kitamura, Hiroyuki and Sugiura, Jiro, **Report on sea and weather observation on Antarctic whaling ground.** *Oceanographical Magazine*, Tokyo, 2(4):149-180, Dec. **1950.** 11 figs., 8 tables. **MH-BH**—Part II contains meteorological data covering the regions 130°E—180°W. Data on atmospheric pressures, air temperature, vapor pressure, frequency of wind direction and average wind velocities by direction, weather, frequency of wind direction with fog, frequency of wind direction with snow and surface water temperatures are given. The pressure patterns and cyclones and the weather on the whaling ground are discussed. *Subject Headings:* **1. Climatic data 2. Antarctic Ocean.**—*I.L.D.*

4.2–232 551.582:551.586:58:59(458)

*Pollastri, Francesco, **Sicilia.** Palermo, Industrie Riunite Editoriali Siciliane, **1948.** 3 v. in 1. figs., tables, charts. **DWB**—Vol. II, entitled "Il Clima," [The climate], discusses in separate chapters: (1) influence of climate on morphology; (2) temperature, rain, snow, sunshine, evaporation, humidity, wind as a factor in distribution of plants and animals, rainfall and temperature stations in Sicily, temperature in period 1931–40, de Martonne index applied to Sicily, climograms for 32 different stations made from mean monthly temperatures and mean monthly variability in temperature; (3) rainfall distribution in Sicily, and index of aridity; (4) effect on water resources; and (5) malaria in relation to climate. Extensive tables of mean annual, seasonal and monthly maximum and minimum temperatures for 1931–40, and total precipitation for each year from 1931 to 1940 plus mean annual and monthly precipitation for that period for 42 stations in Sicily are appended. *Subject Headings:* **1. Climate of Sicily 2. Temperature variations 3. Precipitation data 4. Morphology 5. Long period records 6. de Martonne index 7. Sicily.**—*M.R.*

4.2–233 551.582(434.7)

*Rentschler, W., **Einige Betrachtungen über das Lokalklima von Hohenheim anhand der 70 jährigen Beobachtungsreihe.** [Some considerations of the local climate of Hohenheim from the 70 year series of observations.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:146–155, **1952.** 6 figs., 12 tables, 15 refs. **DWB**—Tables and diagrams show for each month decadal and long period (1881–1950) values of mean and extreme temperature, summer, frost and ice days, precipitation and sunshine duration (1896–1940). Frequency diagrams are given. *Subject Headings:* **1. Local climates 2. Long period records 3. Hohenheim, Germany.**—*C.E.P.B.*

4.2–234 551.582:631.48

Schaufelberger, P., **Zur Klassification der ariden tropischen Böden.** [On the classification of arid tropical soils.] *Experientia*, Basel, 8(9):361–364, Sept. 15, 1952. tables, refs. English summary p. 364. **DWB**—Tropical soils are classified according to rainfall as primeval forest, forest, humus, bamboo, cactus, and their chemical composition described. Soils of various localities are then described and related to rainfall, temperature and "rain factor," and the origin of different types discussed. *Subject Headings:* **1. Soil types 2. Rainfall index 3. Climatic effects.**—*C.E.P.B.*

4.2–235 551.582:711

Schirmer, Hans, **Die Verwendung klimatologischer Karten in der Landesplanung.** [The application of climatological charts to country planning.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:139–143, **1952.** 22 refs. **DWB**—For use in regional planning, series of climatic charts are proposed. These would include: 1) various aspects of temperature, 2) precipitation (rain, snow, thunder), 3) technical climatology (fog, heat, wind force, greatest snow load) and 4) phenology. Elements and scale vary according to purpose, from state to town and house planning. *Subject Headings:* **1. Climatic surveys 2. Regional planning.**—*C.E.P.B.*

4.2–236 551.582(4,5)

Yamamoto, T. (*Yamaguchi Univ.*), **On the relation between the climates of Europe and Asia.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 30(3):73–102, March **1952.** In Japanese, English summary p. 73. 21 figs., 14 tables. **MH-BH**—Using the pressure difference between Milan and Haparanda in Europe as zonal index, the author found a high contemporary correlation with January–February temperature of Irkutsk ($R = .73$ for $n = 53$ years) and with the air pressure in high latitudes ($R = .80$ to $.95$); the contemporary correlation coefficient with air temperature is high in Europe, decreases sharply at 50°E and is high again in Asia. A lower correlation is found for the temperature in Japan. A possible influence of sunspots is shown and climatic changes are discussed using old records (700–1700) of the mean full bloom date of cherry trees. *Subject Headings:* **1. Climatic correlations 2. Sunspot effects 3. Climatic changes 4. Phenology 5. Europe 6. Asia 7. Japan.**—*A.A.*

4.2–237 551.582.2:551.21(72)

*Fries, Carl, Jr. and Gutiérrez, Celedonio, **Activity of Parícutin Volcano from July 1 to December 31, 1950.** *American Geophysical Union, Transactions*, 32(4):572–581, Aug. **1951.** 8 figs., 4 tables, 3 refs. **DWB**—Monthly summaries of temperature, rainfall, relative humidity, wind direction and ashfall near Parícutin Volcano for the period July–Dec. 1950, and rainfall and ashfall at Cuezeño and Equijuata for yearly periods from Jan. 1947 to Dec. 1950 are given. There seems to be no relation between precipitation and eruptive activity. *Subject Headings:* **1. Climatic data 2. Vulcanology 3. Parícutin Volcano, Mexico.**—*I.L.D.*

4.2–238 551.582.2(436)

*Innsbruck. Universität. Meteorologisches Observatorium, **Beobachtungen in den Jahren 1941 bis 1945 und 1947.** [Observations for 1941 through 1945 and 1947.] Pref. Oct. **1950.** 16 p. entirely tables. **DWB**—Monthly and annual means are given for air pressure, temperature, relative humidity, vapor pressure, evaporation and sunshine duration. Tables present the diurnal course of the wind velocity of the sunshine duration and of the rainfall amount and frequency. The most rainfall is concentrated during the night. *Subject Headings:* **1. Climatic data 2. Innsbruck, Austria. I. Defant, Albert.**—*A.A.*

## CLIMATIC CHANGES

*See also items:* 4.2–215, Snow conditions, last 50–60 years, central NW Germany (Brose); 4.2–259, Seasonal climatic contrasts, N and S of Riesen Gebirge (Weiss)

4.2–239 551.583

Chassany, J. (*Laval Obs., St.-Genes, France*), **La température pendant un siècle dans la région de Lyon.** [Temperature during one century in the region of Lyons.] *Revue de Géographie de Lyon*, 27(1):57–61, **1952.** 2 figs., table, ref. **DWB**—Curves of mean annual

temperature 1851–1950 for Lyon or nearby stations are presented and analyzed. Monthly curves 1885–1945 are also given. A rising tendency from 1890–1950 is evident for every month (except Jan. and Nov.) and for the year as a whole. In Jan. and Nov. a maximum occurred in the 1930–1940 period, followed by a decrease. *Subject Headings:* **1. Long period records 2. Climatic variations 3. Lyons, France.**—*M.R.*

4.2–240 551.583

Estienne, Pierre, **Le problème des variations climatiques en pays tempéré.** [The problem of climatic variations in temperate regions.] *Revue de Géographie Alpine*, Grenoble, 40(2) 241–263, **1952.** 3 tables, 36 refs. French and English summaries p. 241–242. **DWB**—A rather general review of the geographical evidence on historic and prehistoric climatic changes. The author reviews critically the evidence on recent climatic changes (data of LYSGAARD), the methods for studying past climatic changes, namely: glacial variations, oceanic temperatures, currents and salinities, geomorphology, pedology and pollen analysis. Data are presented showing that the mean annual temperature is increasing in the Arctic and subarctic zones but not in the Mediterranean region. The possible causes of climatic variations, namely changes in the solar radiation (variations in ultraviolet) and variations in atmospheric circulation are discussed. *Subject Headings:* **1. Climatic changes 2. Solar radiation 3. Atmospheric circulation.**—*I.L.D.*

4.2–241 551.583:581.1(47)

P'iavchenko, N. I., **O peremeshchenii rastitelnykh zon na severe Vostochnoĭ Evropy i Zapadnoĭ Sibiri v poslelednikovoe vremia.** [Shift of plant zones to the north in eastern Europe and western Siberia during postglacial time.] *Akademiia Nauk, SSSR, Doklady* 84(1):127–130, **1952.** 16 refs. **DLC**—Twenty-three pollen diagrams showing the change in forest vegetation as indicated in plant deposits up to a thickness of 3 m have been constructed for regions of southern Yamal, the Bol'shezemel'skaia tundra, the lower Pechora and the Kola Peninsula. In these regions of northeast European Russia and western Siberia climatic change and northward shift of vegetation proceeded synchronously. Four phases differ among themselves in climatic conditions, extent of forest cover and nature of plant formation are distinguished and are analyzed. *Subject Headings:* **1. Plant ecology 2. Postglacial period 3. Climatic changes 4. Forest vegetation 5. U.S.S.R. 6. Siberia.**—*I.L.D.*

4.2–242 551.583.13:519.2

Lewis, R. P. Waldo and McIntosh, D. H., **Some effects of the coherence of meteorological time-series.** *Meteorological Magazine*, London, 81(962):242–244, Aug. **1952.** 4 refs., eqs. **MH-BH**—An expression is derived for estimating the number of effectively independent terms $\epsilon(n)$ in a series of $n$ terms (e.g., daily values of pressure or temperature) showing coherence (persistence). *Subject Headings:* **1. Statistical analysis 2. Persistence.**—*C.E.P.B.*

4.2–243 551.583.2:551.311.12

Ahlmann, Hans Wilhelmson, **Glacier variations and climatic fluctuations.** American Geographical Society, Bowman Memorial Lecture, Aug. 13, **1952,** in Washington, D. C. 9 p. Mimeographed. **NNA**—This advance copy does not include any diagrams or photographs. Recent studies in Greenland and Antarctic show that volume of existing glacier ice is 26–36 km³. Glaciers are generally retreating except in Alaska (variable) and Western America (tending to increase since 1945), but there are indications that trend has changed. Biological results are summarized. History of glaciers since 8000 B.C. set out. *Subject Headings:* **1. Climatic variations 2. Glaciers. I. American Geographical Society. Bowman Memorial Lectures.**—*C.E.P.B.*

## MICROCLIMATOLOGY

*See also items:* **4.2–130,** Insolation (Kaemfert and Morgen); **4.2–145,** Vertical climatic differences in lowest strata of atmosphere (Kosiba); **4.2–227,** Climatic causes and factors (KHromov); **4.2–262,** Plan for a regional climatic survey (Knoch)

4.2–244 551.584.3

Lehmann, Paul, **Abkühlung und Erwärmung im nächtlichen Kaltluftfluss.** [Cooling and warming in nocturnal cold air flow.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:113–116, **1952.** 3 figs., 12 refs. **DWB**—The flow of cold air into a depression

s discussed. The paradox that cold air comes from a warm slope is attributed to the fact that he flow is turbulent and radiates heat from its upper surface. *Subject Headings:* **1. Topographic effects 2. Katabatic winds.**—*C.E.P.B.*

4.2–245 551.584.4:551.577.21

Linskens, Hansferdinand, **Niederschlagsverteilung unter einem Apfelbaum im Laufe einer Vegetationsperiode.** [Rainfall distribution under an apple tree during a vegetation period.] *Annalen der Meteorologie*, 5(1–2):30–34, **1952.** 12 figs., table, 5 refs. German and English summaries p. 30. **DWB**—Thirty rain gages were exposed under an apple tree with a crown 6 m across, with 3 in the open. Observations for a year from March 1, 1949, are divided into 10 periods according to leaf stage, and shown as percentages of the amount in the open. Those during period in leaf clearly show the umbrella effect of the crown, amounts increasing outwards from below 40% near trunk to up to 105%, 54 cm from stem. *Subject Headings:* **1. Vegetative influences 2. Precipitation interception.**—*C.E.P.B.*

4.2–246 551.584.6

Kern, Helmut, **Mietentemperaturmessungen auf Niedermoorboden.** [Rick temperature measurements on low peat soil.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:186–189, **1952.** 4 figs., tables, 5 refs. **DWB**—It is found that unventilated potato ricks on peat soil do not readily fall to correct temperatures. Ricking should be as late as possible and temperature control carried out. A "rick climate service" is proposed for the Danube peat region. *Subject Headings:* **1. Rick temperatures 2. Potato storage.**—*C.E.P.B.*

4.2–247 551.584.61:551.524

Gormosov, M. S., **Mikroklimat zhilishch i ego gigienicheskoe izuchenie.** [Microclimate of dwellings and its investigation.] *Gigiena i Sanitariia*, 8:3–11, Aug. **1951.** 2 tables. **DLC**—Soviet work on the comfort temperatures of dwellings in various climatic regions of the USSR is reviewed; the physiological basis of temperature regulation is discussed briefly; and names of Soviet investigators studying comfort temperatures are listed. The results of a questionnaire study of optimum winter temperatures in diverse climatic zones (I—cold; II—moderately cold; III—temperate; IV—warm; V—hot) are given. There were 3722 replies received from a population of both sexes aged 18 to 65 years. The winter comfort temperatures were highest in the cooler zones and lowest in the warmer zones; below 20°C in the hot zones and between 20–22°C in the cold zones. The distribution of winter temperatures within dwellings situated in these climatic zones corresponded to the comfort questionnaire data. Comfort indoor temperatures for residences established in various zones of the USSR are given; they are viz: I—21–22°C; II—18–21°C; III—18–20°C; IV—17–19°C; V—17–18°C. Also results of experimental study of effect of atmospheric temperature upon skin temperature and electrical conductivity of skin are given. *Subject Headings:* **1. Indoor climates 2. Indoor temperatures 3. Physiological climatology 4. Comfort climate 5. U.S.S.R.**—*I.L.D.*

4.2–248 551.584.61:677.05(52)

Kubo, J., **On the climate in the cotton spinning and weaving mill.** *Japan. Central Meteorological Observatory, Tokyo, Memoir of Industrial Meteorology*, 15(1):79–86, May, **1951.** 5 figs., 4 tables, 5 refs. English summary p. 86. **DLC**—An investigation to determine the most favorable combinations of temperature and humidity in mills for promoting the most efficient cotton spinning and weaving. Air conditioning in mills is discussed. *Subject Headings:* **1. Indoor climates 2. Air conditioning 3. Cotton mills 4. Industrial climatology 5. Japan.**—*A.A.*

4.2–249 551.584.61

Woolrich, W. R. (*Univ. of Texas*), **Warm climate livability of six Texas houses.** *Heating and Ventilating*, 49(5):73–78, May **1952.** 9 figs. **DWB**—An investigation of living conditions in six houses of different construction and in different surroundings was started in Austin, Texas, by Acme Brick Co. and the Univ. of Texas. The climate of the region is described. Theoretical and experimental data of air flow and temperature are presented in graphical form

for the houses investigated under varying conditions, such as open or closed windows, use o fans, roof spray, etc. *Subject Headings:* **1. Indoor climates 2. Austin, Texas.**—*G.T.*

## CLIMATIC CLASSIFICATION

4.2–250 551.58

Dammann, Walter, **Zur Festlegung der Klimabereiche.** [On the determination o climatic regions.] *Germany. Deutscher Wetterdienst in der US Zone, Berichte*, No. 38:137 138, 1952. 6 refs. **DWB**—Author refers to HUMBOLDT's definition of climates by thei effects and outlines proposals for a science of economic climatology. *Subject Heading:* **1. Cli matic classifications.**—*C.E.P.B.*

4.2–251 551.585:551.571.36:551.588.

Karapipieris, Photios P., **The influence of ground condition and cloudiness of the diurna march of surface vapor pressure at Blue Hill, Milton, Massachusetts.** *American Geophysica Union, Transactions*, 32(4):547–551, August **1951.** 6 figs., table, refs. **DWB**—The character istics of the oceanic, continental, steppe and desert type of diurnal march of vapor pressure ar described. A study of the diurnal march of vapor pressure at Blue Hill has revealed an oceani type when the ground is snow covered or the sky is overcast and during Jan. and July; continental type when the sky is clear and the ground is moist and during April and Oct and the steppe type when the sky is clear and the ground is either dry or bare and frozen *Subject Headings:* **1. Climatic types 2. Diurnal vapor pressure variations 3. Blue Hil Massachusetts.**—*I.L.D.*

4.2–252 551.585.3:551.501.45:551.577.32(54

Chatterjee, Sujan Bandhaba, **General methods in climatology; Indian climostatics** *Calcutta Geographical Review*, 12(2):1–26, June **1950.** diagrs., graphs, tables. **DWB** Th monsoons are found to be an element of unity among numerous factors of variety in India weather conditions. Observational data related to the Jan. and July monsoons are represente in tables, charts and curves on the basis of the percentage of total annual rainfall occurrin at those seasons. A regional classification and analysis of total rainfall amounts in India i presented. *Subject Headings:* **1. Climatology 2. Monsoon rains 3. Statistical technique 4. India.**—*G.T.*

4.2–253 551.585.53(661

Menchikoff, N. (*Director Béni-Abbès Center*), **Station saharienne de Béni-Abbès. (Terri toires du sud-sud oranais.)** [Saharan station of Béni-Abbès. (Territory of south-sout Oran).] *France. Centre National de la Recherche Scientifique, Journal des Recherches*, No 17:88–93, Dec. **1951.** 12 photos. **DWB**—This station was chosen by the Centre Nationa de la Recherche Scientifique for a desert research center because it combined the proximit of vast dunes, bad-lands, coulee and mountain massif. It is at 30°8′7″N and 2°1′5″W, eleva tion 500 m, 227 km south of Colomb-Béchar (which can be reached by air or rail) and consist of an oasis of 7–8,000 palms. This center was conceived by the author in 1938, but was no initiated until 1945. The geophysical observatory makes magnetic, electric, solar, soil moistur (dunes), sand movement (surface and in air) and aerological studies or observations, an maintains a close liaison with the Bellevue Laboratory. Many other fields are included in th program of this center. *Subject Headings:* **1. Desert research centers 2. Meteorologica research 3. Béni-Abbès, Oran 4. Sahara Desert.**—*M.R.*

4.2–254 551.585.55:08(47

Akademiia Nauk, SSSR. Institut Fiziologii Rastenii im. K. A. Timiriazeva, **Klassik russkoĭ agronimii v bor'be s zasukhoĭ.** [Classics of Russian agronomy dealing with th struggle against drought.] Moscow, **1951.** 484 p. figs., tables, refs. **DLC**—The classic reprinted are as follows: "Our steppes before and now" by V. V. DOKUCHAEV; "How ou steppe became arid" by A. A. IZMAIL'SKIĬ; "The struggle against drought in the chernozem regions by cultivation of fields and by collecting snow on them" by P. A. KOSTYCHEV; "Th struggle of plants against drought" by E. A. TIMIRIAZEV; "Chapters from the selected writing

on the problems of climatology" by A. I. Voeĭkov and "Selected writings on problems of the struggle against drought" by V. P. Vil'iams. The monographs by Dokuchaev, Voeĭkov, Zmail'skiĭ and Kostychev will be abstracted fully. *Subject Headings:* **1. Steppes 2. Drought 3. Collected works 4. U.S.S.R. I. Maksimov, N. A.** (*ed.*).—*I.L.D.*

## BIOCLIMATOLOGY—APPLIED CLIMATOLOGY

*See also items:* 4.2–151, Soil temperature in field of rice planted directly (Tsuboi and Yukino); 4.2–225, Where winter never comes (Bates); 4.2–232, Sicily (Pollastri); 4.2–268, Microclimate and late frosts in NE Vogelsberg (Knapp, G. and Knapp, R.); 4.2–278, Atmospheric electricity in bioclimatology (Israël)

4.2–255 551.586

Berenson, G. S. and Burchi, G. E. (*Tulane Univ. School of Medicine, N. Orleans*), **The response of patients with congestive heart failure to a rapid elevation in atmospheric temperature and humidity.** *American Journal of the Medical Sciences*, Philadelphia, 223(1):45–53, Jan. **1952.** 3 figs., 2 tables, 17 refs. **DLC**—A clinical study of 25 subjects (13 control and 12 with conditions of chronic congestive heart failure) subjected for 40 to 14 min to atmospheric conditions in which the air temperature was 40°C and the relative humidity 85% (to 15%). The clinical readiness of the normal individuals and of those with heart diseases are itemized. The latter manifested reactions basically similar to but less predictable than those for the former. The hot and humid summer days brought about acute attacks of left ventricular failure characterized by severe dyspnea râles and gallop rhythm associated with apprehension and panic. *Subject Headings:* **1. Medical meteorology 2. Heart disease.**—*I.L.D.*

4.2–256 551.586:016

†Cordes, H., **Bibliographie "Klima und Mensch," 1945–1949, Zusammenstellung und Referate von Dr. H. Cordes.** [Bibliography "Climate and Man," 1945–1949, compilation and abstracts by Dr. H. Cordes.] Bad Kissingen, **1950.** 96 p. **DWB**—A well-organized and annotated bibliography of 445 items published in German (with a few foreign articles) during the post-war period (1945–49). Lists major meteorological and medical periodicals from which the literature is selected (with editor and plan of publication of each). References are to: 1) basic works, texts, history, research methods, instrumentation, 2) works on specific meteorological elements, 3) physiological climatology (skin, blood, respiration, nervous system, acclimatization, etc.), 4) meteorology (pathology, effect of seasons, epidemiology), 5) climatotherapy and 6) indoor and city climate. *Subject Headings:* **1. Bioclimatology 2. Bibliographies. 3. Germany. Deutscher Wetterdienst in der US-Zone.**—*M.R.*

4.2–257 551.586:016

†Petersen, William Ferdinand, **Publications.** *Journal of Human Ecology*, Crystal Lake, Ill., 1(12), **1951.** 22 p. 220 citations. **DWB**—This bibliography contains references to the extensive writings of Dr. W. F. Petersen on the role of weather in the etiology and symptomatology of human disease and on the importance of weather in "human destiny." It is thus a useful compilation of the bioclimatology aspect of contemporary pseudoscience. *Subject Headings:* **1. Bioclimatology 2. Bibliographies. I. Sargent, Frederick, II** (*comp.*) **II. Sargent, Virginia W.** (*comp.*).—*I.L.D.*

4.2–258 551.586:631.56:633.491:551.556

Hummel, Fritz, **Mietenklima und Windeinfluss.** [Rick climate and wind influence.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 32:44–47, **1952.** 9 figs. **DWB**—The author investigated the effects of air temperature, precipitation, snow cover and wind on potato storage bins. An optimal storage temperature of 2–4°C can be attained by exposing the storage bins in a north-south direction. The bins must be protected on the windward side during advective frost. The best practical method is the use of impregnated paper. *Subject Headings:* **1. Agricultural meteorology 2. Crop storage 3. Wind effects 4. Potatoes 5. Germany.**—*A.A.*

4.2–259 551.586:551.43:551.583.13(436)

Weiss, Ingrid (*Mörfelden/Hesse*), **Jahreszeitliche Klimagegensätze an der Nord- und Südseite des Riesengebirges.** [Seasonal climatic contrasts on the north and south of Riesen Gebirge.] *Wetter und Leben*, 4(3/4):58–62, April **1952.** 2 figs., 6 tables. **MH-BH**—An analysis of the seasonal weather regime in order to utilize to a maximum degree the resort possibilities of various localities north and south of the Riesen Gebirge. Data on precipitation and wind velocity which are presented in tables show contrasting climatic differences on opposite slopes. *Subject Headings:* **1. Mountain climates 2. Mountain resorts 3. Seasonal variations 4. Riesen Gebirge, Germany.**—*I.L.D.*

4.2–260 551.586:612:551.581

Moniak, Jan, **Zagadnienie aklimatyzacji człowieka w strefie gorącej.** [The problem of acclimatization of man in tropical regions.] *Przegląd Meteorologiczny i Hydrologiczny*, Warsaw, v. 1950–1951:123–140, **1951.** fig., 15 refs. English summary p. 139–140. **DWB**—The problem of the possibility of acclimatization in the tropical belt of men coming from temperate zones is discussed from the point of view of the influence of regional climatic factors. The most important factors are: 1) high temperatures (over 25°C) combined with high relative humidity (over 85%), 2) intensive action of solar radiation, 3) increased cloudiness and frequent fogs, 4) monotony of the weather and 5) effect of winds. After having examined the possible effect of these factors separately, the author states that the difficulty of the problem lies in the fact that the effect of the climate is due to the joint action of all climatic factors, while the elements and their action are studied separately. *Subject Headings:* **1. Acclimatization 2. Tropical climatology.**—*A.M.P.*

4.2–261 551.586:61?

Riedel, G., **Klimatologisch-physiologische Studie über die Grenzen der Hitzeerträglichkeit.** [Climato-physiological studies on the limits of heat resistance.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:273–277, **1952.** fig., 3 refs. **DWB**—Reports of "comfortable" and "bearable" by troops in tanks during the war are related to external climatic conditions. The investigation met difficulties and a new apparatus is described for measuring calorimetrically the heat loss of the human skin. *Subject Headings:* **1. Heat loss 2. Skin temperatures.**—*C.E.P.B.*

4.2–262 551.586:63:551.584.2(431/5)

Knoch, Karl, **Plan einer Landesklimaaufnahme.** [Plan for a regional climatic survey.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 32:106–108, **1952.** **DWB**—The construction of maps of local climate (1:25,000) for larger regions, which give data for agricultural and other practical purposes, is suggested. The maps should indicate localities favorably and unfavorably situated with respect to frost and wind protection, flood possibilities, soil erosion, etc. *Subject Headings:* **1. Agricultural meteorology 2. Local climates.**—*A.A.*

## UPPER AIR CLIMATOLOGY

4.2–263 551.587(02

American Museum of Natural History, New York, Hayden Planetarium, **Aerology; the science of the atmosphere.** New York, **1951.** 47 p. figs. **DLC**—Primarily an explanatory text for the animated dioramas of basic weather phenomena displayed at the Hayden Planetarium since December 1946, this booklet will also supply fundamental weather information for the general public or students of elementary meteorology. Eight chapters, illustrated with one of the Willets Memorial dioramas deal with physical properties of the atmosphere, the formation of clouds and rain, classification of clouds, fronts and cyclones, and radar weather detection. Chap. 9 gives a brief history of the foundation with a picture of J. P. Willets. *Subject Headings:* **1. Elementary meteorology 2. Aerology 3. Dioramas 4. Textbooks.**—*G.T.*

4.2–264 551.587(98

†*Flohn, Hermann, **Zur Aerologie der Polargebiete.** [On the aerology of the polar regions.] *Meteorologische Rundschau*, 5(5/6, 7/8):81–87, 121–128, May/June, July/Aug. **1952.** 5 figs.

:8 tables, 53 refs. **DWB**—The lower atmosphere over polar regions is divided into a ground nversion with very steep negative lapse rate and a much deeper main inversion layer of small radient extending occasionally up to 4 km. This structure is especially marked with free adiation from snow covered ground—examples quoted. The mean stratosphere temperature t 200–50 mb levels increases poleward during summer (but not winter) due to direct absorption f solar radiation. In the second part, the rich aerological material for several Arctic stations 948–52, is summarized for variability and extremes of temperature, surface to 100 mb, requency distribution of height and amount of main inversion (Yakutsk), vapor pressure nd relative humidity (to 500 mb), wind direction and constancy (to 12 km), and height of tandard isobars. Atmospheric circulation is discussed and the asymmetric polar whirl llustrated by mean height of 500 mb surface. Comparisons are made with Antarctic. *Subject Headings:* **1. Upper air climatology 2. Arctic.**—*C.E.P.B.*

4.2–265 551.587:551.555.6(82)

Georgii, Walter, **Studie zur Aerologie Argentiniens.** [Studies on Argentine aerology.] *ermany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:303–311, **1952.** 14 figs., tables, 7 refs. **DWB**—Meteorological flights at Trenque Lauquen (Buenos Aires Prov.) eb. 25–March 6, 1952 compared with other stations show temperatures of tropical and polar ir, and structure of a pampero. Temperatures and humidities in lee waves of the Cordilleras re described, with illustrations, and their effects compared with those at Mendoza. *Subject Headings:* **1. Upper air climatology 2. Pamperos 3. Lee waves 4. Argentina.**—*C.E.P.B.*

## ENVIRONMENTAL INFLUENCES

*See also items:* **4.2–130,** Insolation (Kaempfert and Morgen); **4.2–205,** Drought weather and its modification (Fedorov and Chubukov); **4.2–228,** Mathematical climate curves outside tropics (von Schelling); **4.2–251,** Influence of ground conditions on diurnal march of surface vapor pressure, Blue Hill (Karapipieris); **4.2–281,** Electric + and − space charges in atmospheric air in fine weather (Mühleisen)

4.2–266 551.588.1

Romanovsky, V., **Influence des océans sur le climat.** [Influence of the oceans on imate.] *La Météorologie*, 4th Ser., No. 24:243–249, Oct./Dec. **1951.** 4 figs. French, nglish and Spanish summaries p. 243. **DWB**—By means of typical examples, the author lustrates the role that the oceans play in determining climate. Continental and maritime imates are defined and the influence of the northward heat transport of the Gulf Stream iscussed with special reference to its effect on Spitsbergen climate. *Subject Headings:* **Oceanic influences 2. Continental climates 3. Marine climates 4. Gulf Stream heat ansport 5. Spitsbergen.**—*M.P.K.*

4.2–267 551.588.2:551.577.3

Buchinskiĭ, I. E., **K voprosu vliianiia vysoty mestnosti na temperaturu i osadki.** [The fluence of the altitude of a region on temperature and precipitation.] *Meteorologiia i idrologiia*, No. 1:21–25, Sept. **1950.** 5 tables, 8 refs. **DLC**—A study on lapse rates of mperature and precipitation in the Ukraine. For this purpose long period observations of pairs of stations with heights up to 1000 m were used. The average lapse rates of temerature were established as +0.5°C, but variations of this rate in individual years are large °.38–0°.71). More satisfactory results were obtained by a comparison of rates for the stations cated on similar form of relief. The lapse rate of temperature is subject to annual variations, nd in summer is higher (up to 1.0), but lower in winter. For reduction of the annual amount precipitation to sea level a formula presented by P. I. Koloskov for similar investigations the Caucasus and Far East was applied. The formula is: $H_0=\frac{H_h}{1+k}$ ($H_0$—precipitation at a level, $H_h$—precipitation at heights of $hm$, $k$—empirical coefficient determined by observaons). The increase of precipitation with height in the Ukraine was 25–27% for every 100 m. *ubject Headings:* **1. Vertical temperature variations 2. Vertical precipitation variations Altitudinal influences 4. Ukraine**—*N.T.Z.*

4.2–268 551.588.2:551.584.31:551.524.3

Knapp, G. and Knapp, R. (*Köln Univ.*), **Beobachtungen über Mikroklima und Spät frosterscheinungen im nordöstlichen Vogelsberg.** [Observations on microclimate and in cidence of late frosts in the northeastern Vogelsberg.] *Wetter und Leben*, 4(3/4):49–5 April **1952.** fig., 15 refs. **MH-BH**—A study of the influence of topography upon the forma tion of local cold air sinks using the frost sensitivity of potatoes as an indicator. Sever frost damage was observed in bottom of valleys and light damage at foot of slopes. Land us is less important in influencing temperature minima than is topography. *Subject Heading* **1. Microclimatology 2. Topographic effects 3. Frost damage 4. Vogelsberg, Germany.**— *I.L.D.*

4.2–269 551.589.1:551.577.3(431/5

von Rudloff, Hans, **Zur Erhaltungs- und Wiederholungsneigung der Witterung im Mitte herbst.** [On the persistence and recurrence tendencies of weather conditions in mid-autumn. *Zeitschrift für Meteorologie*, 6(5):148–151, May **1952.** 4 tables, 6 refs. **DWB**—An analys of the rainfall data for Freiburg over the period 1888–1951 shows that in all years for which th rainfall on Oct. 1, 2, 3 was 0.1 mm, Oct. had an above normal rainfall and at least 14 rain days in central Europe 82% of the Octobers had above normal rainfall. With rainfall on Oct. 2, 93% of Oct. had above normal rainfall in Freiburg and 71% in central Europe. Th phenomenon is associated with the relatively high high-pressure situations in southwes Germany. The conditions favoring the tendency to late fall are discussed. *Subject Heading* **1. Synoptic climatology 2. Rainfall data 3. Long period records 4. Germany.**—*I.L.D.*

## MISCELLANEOUS APPLICATIONS

### COSMICAL INFLUENCES

*See also item:* **4.2–148,** Stratospheric warmings, winter 1951/52 (Scherhag)

4.2–270 551.590.21:634

Weger, Nikolaus, **Weinernten und Sonnenflecken.** [Wine harvest and sunspots *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:229–237, **1952.** 3 figs 3 tables, 10 refs. **DWB**—From wine register at Johannisberg since 1719 no definite correlatio was found between sunspot maxima and high wine yield or quality. Good wine harves did not always follow hot and dry summer weather. Annual yield is tabulated 1719–195 *Subject Headings:* **1. Sunspot effects 2. Viticulture.**—*C.E.P.B.*

4.2–271 551.590.2

Brandtner, Erwin, **Über die Existenz lunarer Witterungsperioden.** [On the existen of lunar weather periodicities.] *Germany. Deutscher Wetterdienst in der US-Zone, Berich* No. 38:329–331, **1952.** 4 figs., 12 refs. **DWB**—The supposed lunar cycle of 29.5 days in th rainfall of Europe in 1909 is examined using other data of pressure and rainfall in Europ and found to be a variant of the 30-day oscillation between continent and ocean, and not lunar origin. Mean amplitude of 29.5 day pressure wave <0.5 mm. *Subject Headin* **1. Lunar influences.**—*C.E.P.B.*

4.2–272 551.590.22(0

Heyer, E., **Immanuel Kant über den Einfluss des Mondes auf die Witterung.** [I manuel Kant on the influence of the moon on the weather.] *Zeitschrift für Meteorolog* 5(9):285, Sept. **1951. MH-BH**—Summary of a paper by KANT (1794) arguing that mo has no direct effect (a lunar atmospheric tide could not be detected). A hypothetical indire chemical effect is postulated. *Subject Headings:* **1. Lunar influences 2. History of meteo ology. I. Kant, Immanuel.**—*C.E.P.B.*

4.2–273 551.590.25:621.3

Greenhow, J. S. and Hawkins, G. S., **Ionizing and luminous efficiency of meteors.** *Natu* London, 170(4322):355–357, Aug. 30, **1952.** 2 figs., 13 refs., 6 eqs. **DWB**—Revised calcul

ons of the heat production, luminous efficiency and ionization of the air by meteors show that nization is much greater than previously supposed (from $10^{13}$ electrons/sec at zenith magtude +3 to nearly $10^{15}$ at −4) in fair accord with theory. Radio echoes of short duration ise from meteors below visibility limit; all visible meteors produce long duration echoes. *ubject Headings:* **1. Meteor trails 2. Reflection echoes.**—*C.E.P.B.*

## OPTICAL PHENOMENA

4.2–274 551.593

Weigel Werner, **Die Sonne springt.** [The sun jumps.] *Zeitschrift für Meteorologie*, (1):30, Jan. **1952. MH-BH**—A description and explanation of the phenomenon known as a jumping sun" which the author observed on April 18, 1951, in connection with observations n the "green flash." The author also discusses the origin of the superstition that associates ie phenomenon of "a jumping sun" with Easter. *Subject Headings:* **1. Green flash 2. Optical henomena.**—*I.L.D.*

4.2–275 551.593.5:551.510.42

Dessens, Henri (*Puy de Dôme Observatory*), **Le soleil bleu de septembre 1950.** [The ue sun in September 1950.] *La Météorologie*, 4th Ser., No. 22:128–131, April–June **1951.** figs., 2 tables, 3 refs. French, English and Spanish summaries p. 128. **DWB**—A photograph ade by the author of the smoke cloud over Puy de Dôme on Sept. 29, 1950 is compared with ie made Aug. 14, 1949 at Saint Gaudens during a grass fire. Chart shows relative values coefficient of absorption vs. wave length and particle size from 0.5 to 2.0$\mu$, with an explanaon of the rarity of a blue sun or moon. The author maintains that a particle size in the arrow range to .8$\mu$ would be expected in this case for a blue color. For green the size must e close to 1.0$\mu$. *Subject Headings:* **1. Blue sun 2. Smoke pall—Sept. 1950 3. Puy de Dôme, rance.**—*M.R.*

4.2–276 551.593.653:551.510.53

KHvostikov, I. A., **Serebristye oblaka.** [Noctilucent clouds.] *Priroda*, Moscow, :49–59, May **1952.** 8 figs., 12 plates, 3 refs. **DLC**—Scientific investigations of noctilucent ouds began in 1885, when V. K. Tseraskiĭ carried out the first systematic observations. he author summarizes the results of observations during almost 60 years in Russia, Germany nd Norway and shows that the most remarkable phenomenon is the stability of the height f the clouds, which was determined by numerous measurements to be at about 82 km above ea level. The observations revealed also that the clouds have a great speed up to scores of /sec with a westerly direction of the motion. Many scientists assumed that the stability f cloud height proves that small particles produce the silvery or noctilucent clouds. The ork of Astapovich published in 1939 established the most probable sizes of particles as .2$\mu$ (confirmed by measurements of diffraction properties of the clouds). Spectrographs show great intensity of light in the short wave region of the spectrum. The author analyzed the ermal and moisture conditions in the stratosphere and lower ionosphere and marked the ost probable zones of cloud formation on a graph of pressure and humidity distribution up to 00 km. These zones are: troposphere, stratosphere, (a) at a height below 33 km and (b) ie layers at heights between 79 and 84 km. At the level of 25–27 km the so-called nacreous ouds occur occasionally and the 79–84 km level is the boundary layer between stratosphere nd ionosphere where the noctilucent clouds were observed. *Subject Headings:* **1. Noctilucent louds 2. Ionospheric research 3. Stratospheric research 4. U.S.S.R.**—*N.T.Z.*

4.2–277 551.593.7:551.521(438)

Smosarski, Władysław, **Polaryzacja atmosferyczna i promieniowanie słoneczne.** [Atmosheric polarization and solar radiation.] *Przegląd Meteorologiczny i Hydrologiczny*, Warsaw, . 1950–1951:148–165, **1951.** 2 tables, 7 refs. French summary p. 165. **DWB**—A comarison of these two phenomena, based on observations made in Golecin from 1927 to 1939. he effect of water vapor and its pressure is discussed in detail. *Subject Headings:* **1. Polariza-ion 2. Solar radiation 3. Water vapor 4. Golecin, Poland.**—*Wanda Tomczykowski.*

## ELECTRICAL PHENOMENA

*See also items:* 4.2–8, Precipitation electricity (Gunn); 4.2–10, Instruments, methods to measure atmospheric electricity (Israël); 4.2–11, Radioactivity of atmosphere (Israël)

4.2–278 551.594:551.5

Israël, Hans, **Die Luftelektrizität im Rahmen der Bioklimatologie. Vorträge und Di kussionen zum obigen Thema am 6/7 März 1951 in Buchau a. F. und Schussenried.** [Atmo pheric electricity in the sphere of bioclimatology. Lectures and discussions . . . at Buch and Schussenried.] *Angewandte Meteorologie*, 1(3):65–69, Dec. 1951. 3 figs. Other pape and discussion p. 70–79. **Teil II.** [Pt. II.] *Ibid.*, 1(4):97–104, Jan. **1952. MH-BH** H. Israël opened by stating the difficulties (accidental correlations, diverse individual r actions, terminology). He summarized the phenomena of atmospheric electricity and point out that since short-period changes do not penetrate 10 cm walls they cannot have dire biological effects; they possibly act through aerosols. Atmospherics (static) were discuss by H. Meinhold (*see also item* 3.4–256, April 1942, *MAB*). K. Rawer described physics the ionosphere, B. Beckmann ionospheric and tropospheric steering of radio waves and H. Siedentopf short wave radiation of cosmic origin and its bioclimatic importance. In t discussion, A. Ehmert demonstrated a new tube electrometer and W. Peppler spoke of t need for combined work. Other topics discussed by several speakers were the penetration houses by the electric field, the need to investigate local disturbances, and bioclimatic reactio to geomagnetic and ionospheric disturbances. Pt. II includes: G. Mall, "Elektro-biologisc Probleme der Medizin und Konstitutionsforschung" (Electro-biological problems of medici and investigation of constitution)—effect of electric shock treatment and atmospheric ele tricity on different physical types; H. Wachter, "Einzelfragen zur Wetterfühligkeit" (Que tions of weather sensivity)—distinction between "Wetterfühligkeit" and "-empfindlichkei (3 refs.); Chr. Junge, "Bemerkungen zum atmosphärischen Aerosol" (Remarks on atmo pheric aerosol)—nature and size distribution; F. Becker, "Erfahrungen mit dem Bioklim gramm" (Experiences with the bioclimagram)—search for effective weather agencies, electr phenomena may be only indicators; H. Ungeheuer "Bioklimatische Untersuchungen Schulkindern" (Bioclimatic investigations with school children)—at Bad Tölz vertical ter perature gradient of previous night, gustiness of night wind, and advective weather chang all unfavorable; H. von Philippsborn, "Neuere Untersuchungen für die Indikationsstellu bei Klimakulturen" (New investigations for the characterization of climatic resorts)—reacti of different patients to sea, hill and mountain climates due to reaction of vegetative nervo system; T. Brocher, "Kritische Bemerkung zum Funktionsablauf des vegetativen System (Critical remark on functioning of the vegetative system)—need for team work between docto and meteorologists; R. Boeckh, "Schlusswort" (Final word). *Subject Headings:* **1. Atmo pheric electricity 2. Bioclimatology. I. Meinhold, H. II. Rawer, K. III. Beckmann, IV. Siedentopf, H. V. Ehmert, A. VI. Peppler, W. VII. Mall, G. VIII. Wachter, IX. Junge, Chr. X. Becker, F. XI. Ungeheuer, H. XII. von Philippsborn, E. XIII. Broche T. XIV. Boeckh, R.**—*C.E.P.B.*

4.2–279 551.594.1:551.5

Israël, Hans (*Air Electric Investigation Center, Buchau, a. F.*), **The diurnal variation atmospheric electricity as a meteorological-aerological phenomenon.** *Journal of Meteorolog* 9(5):328–332, Oct. **1952.** 8 figs., 6 refs., 7 eqs. **MH-BH**—In the modern view, variations atmospheric electricity are controlled by a current generated by world thunderstorm activi balanced by a remote air-earth current which depends on the resistance of the air colum Changes in the latter are due to changes in the aerosol caused by austausch in the lower atmo phere. This is illustrated by diurnal variations of potential gradient, air-earth current a conductivity on Jungfraujoch, and of potential gradient and air-earth current at Zugspit and Buchau. It is shown from these that diurnal variation of austausch in Alps reach 3472 m in summer (compared with 2500 m in free air) but not in autumn. *Subject Headin* **1. Atmospheric electricity measurement.**—*C.E.P.B.*

4.2–280 551.594.1:551.594.21

Kasemir, Heinz Wolfgang, **Die Stromausbeute des Gewittergenerators in Bezug auf den uftelektrischen Vertikalstrom der Schönwettergebiete.** [The current output of the thunderstorm generator in relation to the vertical current of the fine weather region.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:428–434, 1952. fig., 8 refs., 43 eqs. German and English summaries p. 428–429. **DWB**—This paper discusses the relations between the fields and currents associated with a thunderstorm regarded as a point source, taking account of the increase of conductivity with height, and the fine weather current between plates represented by the earth's surface and the ionosphere. *Subject Headings:* **1. Atmospheric electricity 2. Thunderstorm electricity.**—*C.E.P.B.*

4.2–281 551.594.1:551.588.7

Mühleisen, R., **Positive und negative elektrische Raumladungen in atmosphärischer Luft bei Schönwetter.** [Positive and negative electrical space charges in atmospheric air in fine weather.] *Naturwissenschaften*, 39(16):376–377, Aug. **1952.** 2 figs., 3 refs. **DWB**—Measurements of potential gradient, ionization and space charge were made in Stuttgart with fixed and movable apparatus. A full report will be published later. Variations were mainly of small extent and originated on earth's surface, e.g., locomotive steam or chemical exhaust gases. The latter gave negative space charges 3 km downwind, but most sources give positive charges, and this affects diurnal variation, especially in winter. *Subject Headings:* **1. Potential gradient 2. Electrical charges 3. Urban influences.**—*C.E.P.B.*

4.2–282 551.594.1:551.574.1

Mühleisen, R. and Holl, W., **Eine neue Methode zur Messung der elektrischen Raumladungsdichte der Luft.** [A new method of measuring the electrical space charge of air.] *Geofisica Pura e Applicata*, 22(3/4):189–194, April/June **1952.** 5 figs., 10 refs. German and English summaries p. 189. **MH-BH**—A waterdrop, falling from a grounded injection-needle within a grounded screening-cage is influenced by the electric space charge of the surrounding air. The drop therefore leaves the point with a true electric charge proportional to the space charge of the air. A method for measuring electric charges on waterdrops is described. Recording of the space-charge is rendered possible as sensitive as about $\pm 10$ electronic charges/m$^3$. Volta potentials cause a zero-uncertainty of $\pm 25$ electronic-charges/cm$^3$. Three measurements can be made in a second. *Subject Headings:* **1. Atmospheric electricity measurement 2. Drop charge.**—*Authors' abstract.*

4.2–283 551.594.11/13(234.3)

Israël, Hans, **Luftelektrizität und Meteorologie.** [Atmospheric electricity and meteorology.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 35:217–223, **1952.** 5 figs., 14 refs. **MH-BH**—Author describes and discusses diurnal variation of electric field; air resistance and vertical current on Jungfraujoch (compared with Potsdam, Kew, etc.). Two types are found; in midsummer one due to austausch which governs the daily variation up to summits of the Alps, and in late autumn a type due to advection. *Subject Headings:* **1. Atmospheric electricity 2. Alps.**—*C.E.P.B.*

4.2–284 551.594.11

Israël, Hans, **Zum Tagesgang des luftelektrischen Potentialgefälles II. Potentialgefälle und Dampfdruck.** [On the diurnal variation of the potential gradient. II. Potential gradient and vapor pressure.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 38:409–411, **1952.** 4 figs., 12 refs. **DWB**—The diurnal variation of potential gradient of different types is closely related to that of vapor pressure—the simple maritime type and the double convective type. This supports the hypothesis that the diurnal variation of potential gradient is governed by mass exchange. *Subject Heading:* **1. Potential gradient.**—*C.E.P.B.*

4.2–285 551.594.21

Holzer, Robert Edward and Saxon, David S. (*Univ. of Calif., Los Angeles, Calif.*), **Distribution of electrical conduction currents in the vicinity of thunderstorms.** *Journal of Geophysical Research*, 57(2):207–216, June **1952.** fig., 2 tables, 10 refs., 11 eqs. **MH-BH**—

A simple bipolar thunderstorm model, in which atmospheric conductivity increases exponen
ially from the earth to a high level conducting layer, is proposed. Calculations show that t
computed current density of the surface of the earth is very sensitive to the height of th
conducting layer; if the maximum conductivity observed at 19 km is persistent, disturbanc
of normal atmospheric conduction by storms may extend to about 100 km. *Subject Headin*
**1. Thunderstorm electricity.**—*C.E.P.B.*

## AURORAS

4.2–286 551.594.5:551.510.5

Heppner, J. P., Byrne, E. C. and Belon, A. E. (*Univ. of Alaska, College, Alaska*), **Th
association of absorption and Es ionization with aurora at high latitudes.** *Journal of Ge
physical Research*, 57(1):121–134, March **1952.** 6 figs., 2 tables, 8 refs. **MH-BH**—Nocturn
Es ionization and "no echo" occurrences, as recorded on H'f records, have been classifi
according to the absence or presence of aurora and to its form when present in the zenith area
The analysis supports the following generalizations: (1) Es ionization increases at successive
greater heights as aurora approaches the College zenith from the north. (2) In the presence
different non-pulsating auroral forms the Es ionization varies with changes in auroral form in
manner similar to the change in luminosity. Likewise, variations in the height of maximu
ionization parallel variations in auroral heights. (3) Complete absorption is only slightly mo
frequent during non-pulsating aurora than during absence of aurora but prevails in the presen
of pulsating aurora. Geomagnetic relationships are discussed. *Subject Headings:* **1. I
ionization 2. Sporadic E layer 3. Auroral types 4. Magnetic storms 5. College, Alaska.**—
*Authors' abstract.*

4.2–287 551.594

Weigel, Werner, **Polarlichtbeobachtungen.** [Auroral observations.] *Zeitschrift f
Meteorologie*, 6(1):30, Jan. **1952. MH-BH**—Report of observations on the aurora boreal
made at Schwerin on Sept. 25, 1951 and in Mecklenburg, Brandenburg and Saxony on Oc
28, 1951. *Subject Headings:* **1. Aurora borealis observation 2. Germany.**—*I.L.D.*

4.2–288 551.594.51:535.3

Meinel, A. B. (*Yerkes Observatory*), **The auroral spectrum from 6200 to 8900 A.** *Astr
physical Journal*, Chic., 113(3):583–588, May **1951.** 3 figs., table, 6 refs. **DWB**—Spect
obtained at Yerkes Observatory during auroral storm of Aug. 18–19, 1950 are presente
showing bands between 6200 and 8900 A with an exposure of 1¼ hours. It is stated that th
infrared region of the auroral spectrum has a number of bands due to molecular and atom
emissions, such as a new system identified as $N^+_2$, the first positive system of $N_2$ and the atmo
pheric system of $O_2$. Permitted atomic emissions lines for NI, OI and H$\alpha$ were discovered
be present. A table shows details of wave lengths, wave numbers and intensities. *Subje
Headings:* **1. Auroral spectra 2. Infrared spectrum of aurora. 3. Yerkes Observatory, Wi
consin.**—*M.R.*

4.2–289 551.594.51:535.33:551.521.6

Petrie, W. and Small, R. (*Dept. of Physics, Univ. of Sask., Saskatoon, Sask.*), **The i
tensities of ultraviolet features of the auroral spectrum.** *Journal of Geophysical Researc
57(1):51–57, March **1952.** figs., 3 tables, 12 refs., 2 append. **MH-BH**—Twenty-eight ultr
violet spectra of the aurora have been secured at Saskatoon with a single prism quartz spectr
graph. Fifteen of these plates have been analyzed with a microphotometer and intensitomete
and integrated relative intensities obtained of the main spectral features. The intensities ha
been corrected for the effects of Rayleigh scattering and ozone absorption. The correcte
intensities are carefully discussed, and it is shown that they yield vibrational temperatur
less than 500°K. This is very different from earlier results, and additional measurements a
desirable. *Subject Headings:* **1. Auroral spectra 2. Ultraviolet spectrum 3. Ozone absorptio
4. Saskatoon, Saskatchewan.**—*Authors' abstract.*

4.2–290 551.594.5

Vegard, Lars, **Great intensity variations of H$\alpha$ and effects in auroral spectrograms take
in rapid succession.** *Nature*, London, 170(4326):536–537, Sept. 27, **1952.** fig., 12 ref

**DWB**—Four spectrograms taken at Tromsö Dec. 3, 1951, are reproduced and discussed. Two show hydrogen lines, two do not. This is discussed in terms of energy and neutralization of solar protons. *Subject Heading:* **1. Auroral spectra.**—*C.E.P.B.*

4.2–291 551.594.52:778.3(495)

Abbott, W. (*Univ. d'Athène & Collège de Spetsai*), **L'aurore boréale du 19 août 1950, photographiée à Spetsai, Grèce.** [The aurora borealis of Aug. 19, 1950, photographed at Spetsai, Greece.] *L'Astronomie*, Paris, 66:67, Feb. **1951.** photo. **DLC**—Also in: *Atmospheric and Terrestrial Physics*, 1(5/6):343–344, **1951.** 2 figs., refs. **MH-BH**—Photograph made at 37°13′N and 25 minutes exposure of an aurora not visible to the naked eye, but of the same storm as was described by Carl Störmer. This is the first auroral photograph made in Greece. *Subject Headings:* **1. Aurora borealis 2. Auroral photography 3. Spetsai, Greece. I. Störmer, Carl.**—*M.R.*

4.2–292 551.594.52:550.385(436)

Trapp, E., **Das Nordlicht vom 28. Oktober 1951.** [Aurora borealis of October 28, 1951.] *Wetter und Leben*, Vienna, 3(11/12):268–269, Dec. **1951. MH-BH**—A description of the aurora borealis based upon voluntary reports of individuals who had observed in various parts of Austria is presented and the frequency of reports received by provinces is listed. Also the magnetic disturbances observed in conjunction with the aurora borealis are described briefly. *Subject Headings:* **1. Aurora borealis 2. Magnetic disturbances 3. Austria.**—*I.L.D.*

# PART II. SELECTIVE ANNOTATED BIBLIOGRAPHY ON TURBULENT DIFFUSION AND MICROMETEOROLOGICAL TURBULENCE

By: *Mollie P. Kramer, Andrew Assur and Malcolm Rigby*

## INTRODUCTORY NOTE

This is the third in a series of annotated bibliographies on various aspects of turbulence. At mospheric turbulence (particularly high level) in its effects on airplane flight and the classical an statistical theories of turbulence (including a few accounts of wind tunnel experiments) were treate fairly extensively in the November and January issues of this publication, respectively. The mor than three hundred references below include what we hope will prove a representative cross sectio of the literature on **micrometeorological turbulence, turbulent diffusion** and **turbulent exchang** A few purely theoretical papers have been included (see subject outline below). For additiona references to pertinent theoretical studies consult bibliography in Jan. 1953 *M.A.B.* A few pape dealing with special meteorological manifestations of turbulence such as dust or sand storms an transport (4B–115, –125, –249), effect of increase in turbulence and hence in errors in rain gag catch with height (4B–1), applications to industrial meteorology (4B–161, –245, –255, –272), later diffusion, Gleitaustausch (4B–145, –212) and effects on sound propagation and extinction (4B–12 –129, –133) *have* been included.

It would have been impossible to find and organize over 1000 references to articles on tu bulence (over 850 of which are abstracted in these three bibliographies), without the untiring ai of *Mrs. Winifred B. Schraitle*, who performed most of the literature search over a period of 2 year in addition to other duties.

## SUBJECT OUTLINE

**Selected papers on the theory of turbulence,** 4B–2, –13, –14, –17, –24, –26, –27, –65, –67, –73, –91, –92, –105, –112, –140, –143, –146, –153, –158, –161, –173, –174, –181, –185, –186, –192, –193, –199, –221, –226, –231, –263, –264, –267, –274, –276, –280, –286, –294, –306, –313, –316, –319, –321, –323 to –325, –327, –328, –331, –336, –339

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Wind deviations and Ekman spiral, 4B– –11, –13 to –15, –24, –32, –47, –7 –73, –108, –143, –224, –225, –230, –322

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Turbulent heat flux, 4B–33, –42, –52, –6 –76, –84, –87, –121, –130, –131, –14 –157, –158, –166, –185, –189, –223, –23 –234, –241, –260, –278, –288, –304

Temperature profiles, 4B–4, –8, –21, –3 –38, –55, –69, –84, –88, –95, –97, –9

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# BIBLIOGRAPHY ON TURBULENT EXCHANGE

## 1870

**4B–1** 551.551:551.508.7

Stow, F. W., **Rain gauge experiments at Hawsker, near Whitby, Yorkshire.** *British Rainfall* **1870.** Compiled by G. J. Symons. p. 6–22. 2 figs., 6 tables, map. Burder, George F., **On the cause of the decrease of rain with elevation.** *Ibid.*, **1871.** p. 33–41. 2 tables. **DLC**—From a series of experiments aimed at determining the factors which influence the catch of rain in gages Stow concludes that the "difference of the angle at which the rain falls is the real cause of the decrease of rainfall upon a horizontal surface with elevation." He briefly discusses the effects of turbulence or gustiness on that critical angle. Some wind data included. G. F. Burder, to the contrary, contends that the actual increase in quantity of rain in the lowest layer of the atmosphere is sufficient to account for the discrepancy in catch between gages above the ground and similar ones on the ground. *Subject Headings:* **1. Rain gages 2. Micrometeorological turbulence 3. Yorkshire England. I. Symons, G. J., (*comp.*) II. Burder, George F.**—*M.P.K.*

## 1873

**4B–2** 551.55

von Helmholtz, Hermann, **Über ein Theorem, geometrisch ähnliche Bewegungen flüssiger Körper betreffend, nebst Anwendung auf das Problem, Luftballons zu lenken.** [On a theorem concerning geometrically uniform motion of fluid bodies, with application to the problem of movement of free balloons.] (*K.*) *Akademie der Wissenschaften, Berlin, Sitzungsberichte*, p. 501–514 June 26, **1873.** **DLC**—Helmholtz presents here the differential equations of motion, extended to cover boundary conditions between two fluids (after Euler with Stokes' frictional influence included), and applies the theory to motion of a ship through water, the flight of a bird through the air, and finally, the flight of a balloon of given size, displacement, weight of motor and cargo, etc. *Subject Headings:* **1. Atmospheric turbulence 2. Equations of motion.**—*M.R.*

## 1879

**4B–3** 551.55

*Köppen, Wladimir Peter, **Beiträge zur Kenntniss der Böen und Gewitterstürme.** [Contributions to knowledge of squalls and thunderstorms.] *Annalen der Hydrographie und Maritime Meteorologie*, 7(7):324–335, **1879.** table, refs. **DWB**—From numerous observations of line squalls snow squalls and thunderstorms, mostly in the British Isles or at sea, the author develops a theory for the relation between air masses, frictional influences, gustiness, formation of squalls, diurnal variation of wind speed and direction, and vertical exchange of momentum and mass. Quantitative estimates are made of amount of air that must be entrained to obtain certain amounts of rainfall (relation between wind speed and total or intensity of precipitation). *Subject Headings:* **1. Squalls 2. Thunderstorms 3. Atmospheric turbulence.**—*M.R.*

## 1887

**4B–4** 551.524.4

Marriott, William, **Results of thermometrical observations made at 4 feet, 170 feet, and 260 et above the ground at Boston, Lincolnshire, 1882–86.** *Royal Meteorological Society, Quarterly urnal*, 13(64):272–279, Oct. **1887.** 4 tables. **DLC**—Observations were made at the base and p of Boston Church tower, Lincolnshire (273 feet above ground) in flat country free from ob- ructions. To avoid climbing the tower each hour, the telethermoscope was used and comparative adings made at hourly, bi-hourly or thrice-daily intervals. These data are compiled to show the urnal and seasonal changes in lapse rate. *Subject Headings:* **1. Vertical temperature gradient Telethermoscopes 3. Boston, Lincolnshire, England.**—*M.R.*

## 1893

**4B–5** 551.551

Langley, Samuel Pierpont, **The internal work of the wind.** *Smithsonian Contributions to nowledge*, 27(2), **1893.** 23 p. 3 figs., 5 plates. **DLC.** French edition: **Le travail intérieur du nt.** *Revue de l'Aéronautique*, Paris, **1893. DLC**—The pulsating, ascending, lateral and whirling otions of the wind are discussed and illustrated by graphs of anemometer readings (for every 25 volutions showing extreme gustiness) July 16, 1887 at Allegheny Observatory and every revolution Washington, D. C., Jan. 14, 1893, SE wind cloudy and Feb. 4, 1893, NW wind and Feb. 20, W wind—every 5 revolutions. Alum-cups. *Subject Headings:* **1. Atmospheric turbulence Wind structure 3. Wind fluctuations.**—*M.R.*

**4B–6** 551.551:551.513

Rudski, M. P., **Bemerkung zu Dr. Köppen's Aufsatz: "Die grossen Strömungen des atmos- ärischen Kreislaufs."** [Remarks on Dr. Köppen's treatise: "The large currents of the atmos- eric circulation."] *Annalen der Hydrographie und Maritimen Meteorologie*, 21:112–113, **1893. LC**—In this note it is shown that the loss of energy (KÖPPEN), in the general or local circula- on of air can be traced back to turbulence. One of the earliest reviews of the new concepts of rbulence initiated by BOUSSINESQ (1873) and REYNOLDS (1883). Evidently HUMPHREYS and BBOT had suggested that fluid motion was rolling or pulsating rather than smooth flowing, and hers (BOUSSINESQ and SAINT VENANT) that it was eddying or whirling. Effect of resistance of sturbances along the boundaries on the critical velocities for turbulent motion and applications air motion as seen in large eddies or in fluctuations of wind vanes, mentioned. Loss of energy rough turbulence said to be enormous in air as well as in fluids in pipes. *Subject Headings:* **1. At- ospheric turbulence 2. Atmospheric circulation. I. Köppen, Vladimir P.**—*M.R.*

## 1905

**4B–7** 551.511 551.551

Kepinski, S., **Über die Differentialgleichung** $\frac{\partial^2 z}{\partial x^2}+\frac{m+1}{x}\frac{\partial z}{\partial x}-\frac{n}{x}\frac{\partial z}{\partial t}=0$. [On the differential uation. . . .] *Mathematische Annalen*, Leipzig, 61(3):397–405, **1905.** ref., 19 eqs. **DWB**— ives fundamental solution with the aid of Bessel functions. Can be easily applied to the study of change near the ground for unsteady cases, if $z$—mean wind; $x$—height above the ground; $m=0$; $=\sigma/A_1$; $\sigma$—density of air; $A_1$—austausch coefficient ($A$) for $z=1$, $A=A_1 z$. *Subject Headings:* **Austausch equation 2. Bessel functions.**—*A.A.*

## 1908

**4B–8** 551.551

***Åkerblom, Filip, Recherches sur les courants les plus bas de l'atmosphère au-dessus de Paris.** Research on the air currents near the ground in Paris.] *Societas Scientiarum Upsaliensis, Nova cta, Ser. VI*, 2(2), **1908.** 45 p. 28 tables, refs., 14 eqs. **DLC**—A beautiful study, based on cords made by ANGOT at various levels on the Eiffel Tower and on the ground for 6 years (1890– ), in which the author considers the effect of stability (lapse rate in temperature) on variation wind from the gradient (as determined from synoptic charts), and also diurnal and seasonal riations. The theory is worked out, assuming simple horizontal motion, and the coefficients of scosity for summer and winter are given. *Subject Headings:* **1. Atmospheric turbulence 2. Wind ofiles 3. Micrometeorology 4. Paris, France.**—*M.R.*

## 1912

**4B–9** 551.551

Wegener, Alfred, **Über turbulente Bewegungen in der Atmosphäre.** [On turbulent movements the atmosphere.] *Meteorologische Zeitschrift*, 29(2):46–59, **1912.** 4 figs., refs. **DLC**—Work of EYNOLDS, COUETTE, BOUSSINESQ and others in laboratory and nature reviewed. Applications

to unstable and stable atmospheric layers, to inversions and stratosphere cited and illustrated. Smoke ejection experiments are described and pulsations in wind and in vertical motions as determined from wind recording instruments and balloons analyzed. Cloud forms are also cited as illustrative of turbulent and laminar motions in the atmosphere (Cu and St, CuNb and false cirrus, etc.) and implications for aeronautics dwelled on. *Subject Heading:* **1. Atmospheric turbulence.**—*M.R.*

## 1913

**4B–10** 551.551

Hergesell, H., **Die Ermittlung der Vertikalbewegungen der Atmosphäre und deren Turbulenz durch einen gefesselten Pilotballoon.** [Determination of the vertical motions of the atmosphere and turbulence through use of a captive pilot balloon.] *Beiträge zur Physik der freien Atmosphäre*, 6:214–224, **1913.** 3 figs., tables, eqs. **DLC**—An early attempt to determine the three-dimensional motions in the atmosphere without using instruments subject to friction. The pilot balloon is fastened to the end of a light frictionless thread and assumes at the end of its ascent an angle dependent on the integrated motion. Enables a number of measurements to be made almost simultaneously instead of at widely spaced intervals as in the case of 1 and 2 theodolite pilot balloon ascents. (Measurements made at Strassburg in 1912.) *Subject Headings:* **1. Turbulence measurement 2. Turbulence in the frictional layer 3. Pilot balloon ascents.**—*M.R.*

## 1914

**4B–11** 551.55

Dobson, G. M. B., **Pilot balloon ascents at the central flying school, Upavon, during the year 1913.** *Royal Meteorological Society, Quarterly Journal*, 40(170):123–235, April **1914.** 9 figs. 6 tables. **DLC**—Results of 97 ascents tabulated and plotted to show variations in wind profile up to 1.5 or 2.0 km under varying conditions of cloudiness, times of day and season. The gradient velocity was reached at 300 m above surface, but gradient direction not until 800 m. This was contrary to findings of J. S. DINES, but in agreement with theoretical calculations of G. I. TAYLOR. Errors due to vertical currents, when single theodolite observations are taken, are seen by a comparison with two-theodolite runs. It is evident that most of the errors due to vertical currents occurred in the lower 500 m, except when winds were strong. Remarks by G. I. TAYLOR, W. N. SHAW and F. J. WHIPPLE on theory of eddy motion and gradient winds are added. *Subject Headings:* **1. Wind profiles 2. Vertical velocity 3. Pilot balloon ascents 4. Upavon, England.**—*M.R.*

**4B–12** 551.55

Shaw, Sir William Napier, **Wind gusts and the structure of aerial disturbances.** *Aeronautical Journal*, London, 18(71):172–181, July **1914.** 11 figs. **DWB**—The report represents an investigation of gustiness by study of anemograms and use of vector diagrams of the wind. *Subject Headings:* **1. Wind structure 2. Gustiness 3. England.**—*M.P.K.*

## 1915

**4B–13** 551.55

Hesselberg, Th. and Sverdrup, Harald Ulrik, **Die Reibung in der Atmosphäre.** [Friction in the atmosphere.] *Leipzig. Universität. Geophysikalisches Institut, Veröffenlichungen, 2nd Ser.* No. 10:241–309, **1915.** 25 figs., 26 tables, refs. **DWB**—The authors apply the hydrodynamic equations of motion to the mean motion of air, introducing a constant of "internal" friction $\eta$ and a constant of "surface" friction $\nu$. For constant $\eta$ the Ekman-spiral is derived. The calculation of $\nu$ was difficult due to the sharp increase of $\eta$ with height near the ground. The influence of turbulence and austausch is discussed. The "frictional force" is calculated for selected places (USA and Germany) and orographic influences discussed. *Subject Headings:* **1. Friction layer 2. Atmospheric turbulence 3. Orographic influences.**—*A.A.*

**4B–14** 551.55

Taylor, Geoffrey Ingram, **Eddy motion in the atmosphere.** *Royal Society of London, Philosophical Transactions, Ser. A*, 215:1–26, **1915.** 5 figs., 3 tables, refs., 20 eqs. **DLC**—A classical paper containing a summary of work done over Grand Banks of Newfoundland in 1913 and the conclusions drawn as to the vertical transfer of heat, humidity and momentum by eddy motion. Observations were made of the temperature, humidity, pressure and wind by means of kites from the ice patrol vessel "Scotia." Trajectories of air parcels were traced back to Labrador and deviation of wind from gradient wind calculated. Relationships between elements are derived and formulated from theory in the light of observed data. *Subject Headings:* **1. Turbulent diffusion 2. Turbulent exchange 3. Wind profiles 4. "Scotia" Expedition, 1913 5. Grand Banks of Newfoundland.**—*M.R.*

## 1916

**4B–15** 551.551

Åkerblom, Filip, **Über die Beziehungen zwischen Luftdruckgradient, Wind und Reibung bei stationärer geradliniger Bewegung.** [On the relation between pressure gradient, wind and friction with stationary, rectilinear motion.] *Arkiv för Matematik, Astronomi och Fysik*, 11(18), **1916.** 19 p. fig., 5 tables, refs., 6 eqs. **DLC**—The direction and magnitude of frictional force in relation to the wind and pressure gradient is worked out both theoretically and from measurements made at Paris (49°) O-Gyalla, Hungary (48°) and the fire ship "Horns Rev" (56°). Then the daily variation of friction and wind on land and at sea is tabulated and discussed. Finally, all of the above factors are tabulated for a dozen locations in different latitudes and longitudes for different seasons. *Subject Headings:* **1. Atmospheric turbulence 2. Frictional effects 3. Surface winds.**—*M.R.*

## 1917

**4B–16** 551.551

Barkow, E., **Windänderung mit der Höhe und Turbulenz.** [Wind variations with height and turbulence.] *Annalen der Hydrographie und Maritimen Meteorologie*, 45:1–6, **1917.** fig., 3 tables, 14 refs. **DLC**—Turbulence shown to be similar to the motion of molecules. Calculations made on the degree of turbulence as a function of wind speed and wind direction. Small amount of data from the German Antarctic Expedition 1911–1912 used. *Subject Headings:* **1. Turbulence in the frictional layer 2. Wind profiles.**—*H.P.K.*

**4B–17** 551.5(02)

Exner, Felix M., **Dynamische Meteorologie.** [Dynamic meteorology.] Leipzig, Teubner, **1917.** 308 p. 2nd ed. Wien, Springer, **1925.** 421 p. 104 figs. **DLC**—Chap. 6, "General dynamics of air currents," includes sections on friction of the air at the earth's surface, internal friction of the air, austausch and turbulence. The last summarizes some of the early literature on turbulence. *Subject Headings:* **1. Atmospheric turbulence 2. Textbooks.**—*C.E.P.B.*

**4B–18** 551.554

*Hellmann, Gustav, **Über die Bewegung der Luft in den untersten Schichten der Atmosphäre.** [On the movements of air in the lowest layers of the atmosphere.] *Meteorologische Zeitschrift*, 34(8–9):273–285, Aug.–Sept. **1917.** fig., 5 tables. **DWB**—Comparison of anemometer readings at various heights (2, 16, 32, 123 and 258 m above the ground) for different times of the day and seasons are used to show the variations in wind speed and wind profile under varying thermal lapse rate conditions and locations (Nauen and Potsdam). Difference between diurnal variations in wind on days or months with strong and with light winds also shown. Conditions are reversed at the higher levels (stronger at night above, during day below). *Subject Headings:* **1. Wind profiles 2. Turbulent transfer of momentum 3. Vertical temperature gradient 4. Potsdam, Germany.**—*M.R.*

**4B–19** 551.551

Seeliger, R., **Die Struktur des Windes.** [The structure of the wind.] *Naturwissenschaften*, 5(51):749–756, Dec. **1917.** 14 refs. **DWB**—The new concept of the structure of the wind as fluctuating around a mean velocity and requiring more sensitive instruments than were previously available, to record, is brought out. The well known Dines and Fuess gust recording anemometers, and the hot wire (GERDIEN and HALM) and pressure variation (GALITZIN) instruments are given as examples. Three types of gustiness are mentioned as appearing from records of microvariations in wind. Vertical movements, high level turbulence, thermal turbulence, orographic turbulence, the coefficient of turbulence, hydrodynamic theory and other ideas of turbulence and wind structure prevalent among the most advanced workers in meteorology and hydrodynamics are reviewed. *Subject Headings:* **1. Turbulence in the frictional layer 2. Wind structure.**—*M.R.*

## 1918

**4B–20** 551.551:551.554

*Mohorovičić, Stjepan, **Istraživanje vjetra u Radziechówu u Galiciji: Dio prvi.** [Structure of winds at Radziechów in Galicia: Part I.] *Jugoslavenska Akademija Znanosti u Umjetnosti, Zagreb, Rad*, No. 219:56–194, **1918.** 2 figs., chiefly tables. **Part II,** *ibid.*, No. 223:203–208, **1920** and No. 226:1–69, **1922.** 10 figs., 32 tables, 47 eqs. **DWB**—Observations of wind, temperature, moisture, cloudiness and pressure from Nov. 1916 to Oct. 1917, at Radziechów 50°18′N, 24°37′E are given in detail. Pilot balloon equipment is described and illustrated. Location of stations is shown, and all the observed and derived wind data for the lower layers of the air (up to 6000 m) given *in extenso*. The last two parts are concerned with the theoretical and actual determination of coefficient of turbulence from the observed wind profile. Many diagrams are included with the extensive tabular

material. *Subject Headings:* **1. Wind structure 2. Wind profiles 3. Atmospheric turbulence 4. Radziechów, Galicia, Poland.**

**4B–21** 551.551

Taylor, Geoffrey Ingram, **Phenomena connected with turbulence in the lower atmosphere.** *Royal Society of London, Proceedings, Ser. A*, 94(658):137–155, **1918.** 7 figs., 4 tables, refs. **DLC**—Using 5 years of temperature observations made on the Eiffel Tower in Paris at 18, 123, 197 and 302 m above the ground, the author computes values of $K$ along the same lines as he did in the 1915 (*see item* 4B–14 above) paper for the Grand Banks of Newfoundland and Salisbury Plain (pibal observation). He found $K$ to be of the order of $10\times10^4$, but varying with seasons and height above ground—much greater than over the sea ($3\times10^2$), but of the same order as from pilot balloon observations at Salisbury Plain ($5\times10^4$). HELLMANN's observations at Potsdam at 2, 16 and 32 m are compared and found to agree essentially. *Subject Headings:* **1. Atmospheric turbulence 2. Wind profiles.**—*M.R.*

## 1919

**4B–22** 551.551

Hesselberg, Th., **Om oordnade rörelser i atmosvären.** [Turbulent motion in the atmosphere.] *Skandinaviska Geofysikermötet, Göteborg, 28–31 Aug. 1918, Förhandlingar*, p. 26–27, **1919. DWB**—Measurements of micrometeorological wind variations show that the motion of air currents is never laminar but irregular or turbulent. Evidence from pressure, temperature, mixing of air masses and frictional effects supports the evidence from wind measurements. The coefficient of friction is 500,000 times as great as would be expected from laboratory experiments. Therefore, diffusion of water vapor, oxygen, gases and heat are propagated differently than one would expect. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulent diffusion.**—*M.R.*

**4B–23** 551.551

Robitzsch, Max, **Beiträge zur Kenntnis der Struktur des Bodenwindes.** [Contributions to the knowledge of the structure of wind near the ground.] *Lindenberg. Aeronautisches Observatorium, Arbeiten*, 13:66–94, **1919.** 35 figs., tables, refs. **DWB**—Description of an instrument with small lag for the automatic registration of wind speed variations and discussion of results obtained during two years of observations. The frequency distribution of maxima and minima is found for the mean wind velocities 7, 10 and 12 m/sec$^{-1}$. The oscillation amplitude for maximum gustiness is linear for the mean velocity. The "normal" gustiness is defined and the diurnal variation of gustiness discussed. *Subject Headings:* **1. Gustiness measurements 2. Wind structure 3. Turbulence statistics.**—*A.A.*

## 1920

**4B–24** 551.551

Brunt, David, **Internal friction in the atmosphere.** *Royal Meteorological Society, Quarterly Journal*, 46:175–185, **1920.** fig., table, refs., 24 eqs. Discussion, p. 184–5. **DWB**—The equations of motion are solved for the case of equilibrium of frictional and shearing forces, assuming a steady state. All of the other forces involved except $R$ and $\beta$ can be obtained from the synoptic chart. $R$ (frictional force per unit volume) and $\beta$ (the angle between the frictional force and the actual wind) in observation do not agree with theory. There are variations in $\beta$ with time of day, with height, with season, etc. Work of HESSELBERG, SVERDRUP and ÅKERBLOOM cited with respect to variations in $K$ (coefficient of eddy diffusion) which affect $\beta$. Table shows $\alpha$ and $\beta$ for a number of European stations in different seasons (Eiffel Tower, O'Gyalla, Horns Rev., etc.) *Subject Headings:* **1. Turbulence in the frictional layer 2. Wind deviation.**—*M.R.*

**4B–25** 551.551 551.577

*Richardson, Lewis F., **Atmospheric stirring measured by precipitation.** *Royal Society of London, Proceedings, Ser. A*, 96(A674):9–18, **1920.** 21 eqs. **DLC.**—An early attempt to compute the eddy diffusivity from the earth's surface to 8.5 km. The formula due to Taylor $\frac{\partial \chi'}{\partial t}=K\frac{\partial^2 \chi'}{\partial h^2}$ (where $\chi$ is either heat, moisture or momentum) ignored variations in density or eddy diffusivity with height. By using the mean rainfall and cloudiness over the earth, the moisture content of the air at 1 km and at 8.5 km (from cirrus measurements and assumption of no precipitation at that level) and using the equation $\frac{\partial \chi}{\partial t}=\frac{\partial}{\partial p}\left(\xi\frac{\partial \chi}{\partial p}\right)$ the values of turbulent diffusion are calculated to ed 3–180 cm$^{-2}$ g$^{-2}$ sec$^{-5}$ at 8500 m, 140,000 at 500 m and 1000 at 0.5 m. Values of $K$ at 500 m obtaineb by HESSELBERG and TAYLOR agree. *Subject Headings:* **1. Turbulent exchange 2. Eddy diffusivity.**—*M.R.*

**4B–26** 551.551

Richardson, Lewis F., **Some measurements of atmospheric turbulence.** *Royal Society of London, Philosophical Transactions, Ser. A*, 221:1–28, **1920.** 4 figs., 4 tables, refs., 35 eqs. **DLC**—Theoretical work which considers the following: shearing stress and eddy viscosity deduced from pilot balloon observations; eddy diffusivity from smoke and parachute dispersal and its theory; Osborne Reynolds' eddy stresses as a measure of gustiness; summary of theory and numerical values of scattering of particles of air; and cumulus eddies in calm weather. *Subject Headings:* **1. Turbulence measurement 2. Turbulence theory.**—*H.P.K.*

**4B–27** 551.551

Richardson, Lewis F., **The supply of energy from and to atmospheric eddies.** *Royal Society of London, Proceedings, Ser. A*, 97:354–373, **1920.** fig., 2 tables, refs., eqs. **DLC**—This paper extends Osborne Reynold's theory of the criterion of turbulence, to make it apply to the case in which work is done by the eddies acting as thermodynamic engines in a gravitating atmosphere in which the air is assumed to be dry. The gist of the solution is contained in equations 4.15 (expressing the average rate at which intrinsic and gravitational energy jointly are being transformed into the energy of eddies) and 5.3 (equation which results when the convective activity given by 4.15 and the Reynold's expression for the supply of energy from the mean wind, 2.3, are inserted in the equation of continuity in the form, 1.10). Some analogies to thermodynamics are introduced, including the conception of an eddy-heat-per-mass, and its diminution when the air expands. *Subject Headings:* **1. Turbulence theory 2. Richardson criterion 3. Atmospheric eddies.**—*From author's introduction.*

## 1921

**4B–28** 551.551

*Castens, Gerhard, **Laminare und turbulente Luftströmung.** [Laminar and turbulent air currents.] *Annalen der Hydrographie und Maritimen Meteorologie*, 49(2):48–54, **1921.** 8 tables, 21 refs. **DLC**—The seasonal and annual frequency of lapse in temperature and change in wind direction, speed and gustiness) between 122 m and 500 m.s.l. are formulated, tabulated and discussed. The calculations are based on 10 years of observations at Lindenberg (3500 soundings), and are made in an attempt to establish the boundary conditions for laminar and turbulent motion with varying lapse rates of temperature. *Subject Headings:* **1. Atmospheric turbulence 2. Wind profiles 3. Lindenberg, Germany.**—*M.R.*

## 1922

**4B–29** 551.524.4

Durward, J., **Diurnal variation of temperature as affected by wind velocity and cloudiness. A discussion of observations on the Eiffel Tower.** *Great Britain. Meteorological Office, Professional Notes*, 3(30):84–91, 1922. **DWB**—Derives values of $K$ on the assumption that eddy conduction is solely responsible for the temperature changes. *Subject Headings:* **1. Diurnal temperature variations 2. Eddy diffusivity.**—*C.E.P.B.*

## 1923

**4B–30** 551.551

Alt, Eugen, **Die ungeordnete Bewegung der Luft und ihre Bedeutung für atmosphärische Probleme.** [Turbulent motion of the air and its significance for atmospheric problems.] *Geographische Zeitschrift*, Leipzig, 29(4):249–260, **1923.** 5 refs. **DWB**—A summary of exchange phenomena in the atmosphere, written for geographers. The physical and logical basis of the theory is explained. *Subject Heading:* **1. Atmospheric turbulence.**—*A.A.*

**4B–31** 551.551

Roberts, O. F. T., **The theoretical scattering of smoke in a turbulent atmosphere.** *Royal Society of London, Proceedings, Ser. A*, 104:640–654, **1923.** 3 figs., tables, 8 eqs. **DLC**—Differential equation for the coefficient of eddy diffusion is applied to several types of artificial smoke production, and a theory of optical opacity of smoke developed. Diagrams illustrate studies. *Subject Headings:* **1. Turbulent diffusion 2. Atmospheric pollution.**—*H.P.K.*

## 1924

**4B–32** 551.511

Hesselberg, Th., **Über Reibung und Dissipation in der Atmosphäre.** [On friction and dissipation in the atmosphere.] *Geofysiske Publikasjoner*, 3(5), **1924.** 26 p. ref., 25 eqs. **DWB**—A very detailed investigation including stability and austausch, irregular motion and the loss of energy by friction. *Subject Heading:* **1. Turbulent exchange.**—*C.E.P.B.*

4B–33 551.511

Molchanov, P., **Ueber einige Besonderheiten atmosphärischer Prozesse die mit turbulentem Zustand der Luft verknüpft sind.** [Characteristics of atmospheric processes that are connected with the turbulent state of air.] *Beiträge zur Physik der freien Atmosphäre*, 11(3):96–100, 1924. table, 6 eqs. **DWB**—The author applies the equation $\frac{\partial\theta}{\partial t}=\kappa\frac{\partial^2\theta}{\partial z^2}$ to the convective heat transfer in the lower layers of the atmosphere, assuming that the turbulence coefficient, $\kappa$, is constant in time and height and a cosine function (with exponentially decreasing amplitude with height) for the distribution of the potential temperature ($\theta$) in time ($t$) and height ($z$) during the day. Formulas for the calculation of $\kappa$ are derived in which $\kappa$ is found proportional to the square of the maximum height ($H$) of the convective layer during the day. $H$ could be determined from ascents. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulence theory 3. Convection.**—*A.A.*

4B–34 551.55

*Poliboranovo, P., **Zur Frage über die Turbulenz des Windes.** [On the problem of turbulence of the wind.] *Beiträge zur Physik der freien Atmosphäre*, 11(4):181–190, **1924.** 3 figs., 3 tables, 3 refs. **DLC, DWB**—Theoretical consideration of simple and cellular convection, leading to compilation of tables and graphs for determination of intensity and extent of turbulence activity in atmosphere. *Subject Headings:* **1. Atmospheric turbulence 2. Convection.**—*M.R.*

## 1925

4B–35 551.511:551.524.4

Chapman, Sydney, **On the changes of temperature in the lower atmosphere by eddy conduction and otherwise.** *Royal Meteorological Society, Quarterly Journal*, 51:101–116, **1925.** 4 tables **DWB**—A further discussion of temperature observations on the Eiffel Tower analyzed by G. I. Taylor, W. Schmidt and J. Durward. From differentials of potential temperature with height and time, estimates of conductive and radiative factors of variation are obtained. Coefficient $K$ was considered to vary with height and time. *Subject Headings:* **1. Turbulent transfer of heat 2. Temperature profiles.**—*C.E.P.B.*

4B–36 551.551

Milch, Wilhelm, **Über Reibung und Austausch infolge von Turbulenz in der Atmosphäre.** [On the friction and exchange resulting from turbulence in the atmosphere.] *Annalen der Hydrographie und Maritimen Meteorologie*, 53:113–126, **1925.** 2 figs., table, refs., 7 eqs. **DLC**—Author investigates if and in what way the movement of a parcel is modified by appearance of other parcels and if the frictional coefficient of the atmosphere can be transferred. Formula for turbulent friction coefficient for the atmosphere discussed. Several austausch observations made. *Subject Headings:* **1. Turbulent exchange 2. Atmospheric turbulence.**—*H.P.K.*

4B–37 551.511:551.551

Nisi, Hisamitu, **Experimental studies on eddies in air.** *Japanese Journal of Physics*, Tokyo, 4(1):1–11, **1925.** 2 figs., 2 tables, refs. **DLC**—Photographic studies of eddies behind spherical, square and cylindrical shaped obstacles are analyzed and tabulated. Effect of dimensions of obstacle also considered. *Subject Headings:* **1. Atmospheric eddies 2. Atmospheric turbulence.**—*M.R.*

4B–38 551.551:551.524.1

Richardson, Lewis F., **Turbulence and vertical temperature difference near trees.** *Philosophical Magazine*, London, 49:81–90, Jan. **1925.** 4 figs., refs. **DLC**—Effect of wind direction (from trees to measuring point) and the necessary conditions for "just no turbulence" are worked out theoretically and empirically and show some agreement with previous studies made by the author. Temperature differences between junctions 4.4 and 18.3 m above the ground were carefully measured in vicinity of trees, and wind speed and direction measured with a Dines anemometer at 26 m and 2 m. Gustiness at 26 m is plotted as a function of temperature difference of the layer below that level, showing low gustiness with stable (cold) air and high gustiness with steep lapse rate. *Subject Headings:* **1. Wind profiles 2. Vertical temperature gradient 3. Forest influences.**—*M.R.*

4B–39 551.551:551.511

*†Schmidt, Wilhelm, **Der Massenaustausch in freier Luft und verwandte Erscheinungen.** [Mass exchange in the free air and related phenomena.] *Probleme der Kosmischen Physik*, Hamburg, v. 7, **1925.** 118 p. 5 figs., tables, eqs., bibliog. p. 114–116. **DWB**—The author, professor at the academy for soil science in Vienna, well known as the founder of the "austausch" theory in meteor-

ology gives here a comprehensive summary of exchange phenomena in the atmosphere and oceans. Convection, diurnal temperature variations, diffusion, evaporation, distribution of seeds by wind, wind drift, and large scale exchange are among the many subjects discussed. In this monograph the physical basis of processes involved is explained and the most necessary formulas given. The author concludes that the mean heat flux is directed from the atmosphere to the earth surface (p. 18), a result that was later discussed in numerous papers as the paradox of SCHMIDT. *Subject Headings:* **1. Austausch theory 2. Atmospheric turbulence 3. Oceanography 4. Turbulent diffusion.**—*A.A.*

## 1926

**4B–40** 551.551

Richardson, Lewis F., **Atmospheric diffusion shown on a distance-neighbour graph.** *Royal Society of London, Proceedings, Ser. A*, 110(756):709–737, April 1, **1926.** 12 figs., 7 refs., eqs. **DWB**—Because atmospheric diffusivity expressed in terms of Fick's equation increases from $2\times10^{-2}$ to $10^{11}$ as the size of the eddies increases from $5\times10^{-2}$ to $10^{8}$ (according to data on $K$ calculated by SCHMIDT, ÅKERBLOM, HESSELBERG, SVERDRUP, DEFANT and others), it is suggested that a new concept be introduced, wherein concentration $q$ is considered to be a function of $l$—the distance between neighbors. Various aspects of the problem are treated in a very convincing manner, and two methods of observing diffusivity suggested; by use of clusters of balloons, and smoke puffs. *Subject Headings:* **1. Turbulent diffusion 2. Turbulence theory 3. Distance-neighbor graphs 4. Atmospheric turbulence.**—*M.R.*

**4B–41** 551.551

Richardson, Lewis F. and Proctor, Denis, **Diffusion over distances ranging from 3 km. to 86 km.** *Royal Meteorological Society, Memoirs*, 1(1):1–16 [**1926**]. 15 figs., 2 tables. Discussion p. 139–141. 2 figs. **DWB.** Also: *Royal Meteorological Society, Quarterly Journal*, 53:149–151, April **1927. DWB**—Coefficients of diffusivity are calculated from scattering of volcanic ash from Mt. Asama, Dec. 1920 and from scattering of toy balloons released at Brighton, Sussex. The standard deviation $\sigma$ from the mean track ranged from 10–86 km (ash) and 3–49 km (balloons). Values of diffusivity, $K$, and of a less variable measure $\epsilon = K/0.33\sigma^{4/3}$ are given for each day; $\epsilon$ increases with mean speed. The results are explored further in the discussion. It is stated that Fick's law does not describe atmospheric diffusion. *Subject Heading:* **1. Turbulent diffusion.**—*C.E.P.B.*

**4B–42** 551.551

Rossby, Carl-Gustav, **The vertical distribution of atmospheric eddy energy.** *Monthly Weather Review*, 54(8):321–332, Aug. **1926.** 6 figs., 6 refs., 20 eqs. **DWB**—Starting from an energy equation given by L. F. RICHARDSON, the author derives a differential equation for the atmospheric eddy energy per unit mass ($E$). Some integrals to the equation for $E$ are given for the case of an unlimited atmosphere at rest. The diffusion of an initially limited eddy supply during different temperature conditions is studied. Finally the equation for $E$ is combined with the equation for eddy convection of heat, and an integral is derived which gives the simultaneous changes in $E$ and $\theta$ (potential temperature) when two infinitely thick adiabatic air layers are separated by a thin superadiabatic layer and overturning sets in. *Subject Headings:* **1. Atmospheric turbulence 2. Atmospheric eddies.**—*From author's abstract.*

## 1927

**4B–43** 551.551

Rossby, Carl-Gustav, **Convection in the free atmosphere and over a heated surface.** *Monthly Weather Review*, 55(1):1–5, Jan. **1927.** fig., 3 refs., 69 eqs. **MH-BH**—Author reduces the characteristics of atmospheric turbulence, for the case of pure convection, with no horizontal mean wind components, to two quantities, $E$ (simultaneous change in the distribution of kinetic energy per unit mass) and $\theta$ (potential temperature). *Subject Headings:* **1. Free air turbulence 2. Convection.**—*M.P.K.*

**4B–44** 551.551

†Rossby, Carl-Gustav, **The theory of atmospheric turbulence—an historical resume and an outlook.** *Monthly Weather Review*, 55:6–10, **1927.** 18 refs., eqs. **DLC**—Development of study of turbulence outlined, and directions for further research indicated. Good review of some of early basic papers. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulence theory.**—*M.P.K.*

**4B–45** 551.551 551.511

Taylor, Geoffrey Ingram, **Turbulence.** *Royal Meteorological Society, Quarterly Journal*, 53:201–211, **1927.** 7 figs. **DWB**—A simple nonmathematical account, illustrated by an experiment (transition from laminar to turbulent flow), effect of density stratification, eddy diffusivity coefficient $K$, transfer of momentum, general characteristics of turbulent motion and ratios of vertical to hori-

zontal gustiness shown by pressure tube anemometer and universally jointed vane at different heights. *Subject Heading:* **1. Turbulent exchange.**—*C.E.P.B.*

**4B–46** 551.511:551.554

Treloar, H. M., **The variation of eddy viscosity with wind velocity and season. A study based on pilot balloon observations at Melbourne.** *Royal Meteorological Society, Quarterly Journal*, 53(224):439–445, Oct. **1927.** 2 figs., table, 3 eqs. **DWB**—From observations at 50 and 150 m, monthly values of $c/p$, where $c$=Richardson's coefficient of eddy viscosity, were computed for 3 ranges of velocity at 50 m (summer $9.2\times10^{-4}$, winter 4.7 year 6.8). The normal temperature difference, $T$, between soil and air at 10 ft was noted for each velocity class, and the relation $c/p=70V_{50}+7V_{50}T$ found to give a good fit. *Subject Headings:* **1. Atmospheric turbulence 2. Eddy viscosity.**—*C.E.P.B.*

## 1928

**4B–47** 551.511

Ekman, V. Walfrid, **Eddy-viscosity and skin-friction in the dynamics of winds and ocean-currents.** *Royal Meteorological Society, Memoirs*, 2(20):161–172, May **1928.** 5 figs., 25 refs., 12 eqs. **DWB**—The relation of the wind profile above the sea to the "gradient current" and the actual current drift below the surface of the sea, and the interaction of the one on the other considered theoretically with due respect to friction, eddy viscosity, time, angular momentum of the earth, etc. The angle $\alpha$ of deviation is computed for various latitudes under conditions which at the poles would make $\alpha=10°$, 15°, 20°, 25° and 30°. The effect of sea bottom drag (and depth) is considered as well as of skin friction at the surface. *Subject Headings:* **1. Eddy viscosity 2. Skin friction 3. Ocean currents 4. Ocean-atmosphere interaction.**—*M.R.*

**4B–48** 551.551

Georgii, Walter, **Über Wirbelbildung an Hindernissen der Erdoberfläche.** [Eddy formation close to the earth's surface.] *Beiträge zur Physik der freien Atmosphäre*, 14:191–197, **1928.** 5 figs., tables, refs. **DLC**—Turbulence theory is applied to study of origin of lee eddies behind buildings and structures (snow, sand, etc.) and behind mountains or hills. The scale of turbulence is given for various wind speeds. Actual examples are worked out from observations taken on and near the Taunus Range near Frankfurt a. M. *Subject Headings:* **1. Turbulence in the frictional layer 2. Lee eddies 3. Turbulence scale 4. Taunus Mountains, Germany.**—*M.R.*

**4B–49** 551.511

Richardson, Lewis F., **A search for the law of atmospheric diffusion.** *Beitrage zur Physik der freien Atmosphäre*, 15:24–29, **1928.** 4 refs., 19 eqs. **DLC**—Observations of atmospheric diffusion from molecular dimensions up to large scale cyclones, show that Fick's equation for atmospheric diffusion is inadequate. No differential equation could be found which gives the observed relationship; $\frac{\partial\sigma^2}{\partial t}=c\sigma^{4/3}$, $\sigma$—standard deviation of a cluster of floating particles; $t$—time; $c$—constant. *Subject Headings:* **1. Turbulent diffusion 2. Fick's equation.**—*A.A.*

**4B–50** 551.551

Sakakibara, Sigeki, **Investigation on the transverse eddy resistance acting on moving air in the lower atmosphere.** *Geophysical Magazine*, Tokyo, 1(4):130–149, March **1928.** 8 figs., refs., eqs., append. *Ibid.*, 2:139–156, Nov. **1929.** 3 figs., 2 tables, refs., eqs. **DWB**—In the first paper the "coefficient of cross eddy resistance" assumed to be independent of height was introduced. In the second paper the same problem is treated assuming, first, that the vector coefficient of eddy resistance varies exponentially with height and, second, that the density of the air also varies exponentially with height. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulence theory.**—*From author's introduction.*

**4B–51** 551.551

*Terada, T., Tamano, M. and Nisida, K., **On gustiness of winds.** *Tokyo. Imperial University. Aeronautical Research Institute, Report*, 3(8):235–270, June **1928.** 18 figs., table, eqs., append. **DWB**—A statistical study of gustiness observed from 1918 to 1924 at Tokyo Imperial University day and night at all seasons. Mechanical and thermal causes are analyzed. *Subject Headings:* **1. Atmospheric turbulence 2. Gustiness 3. Tokyo, Japan.**—*M.P.K.*

1929

**4B–52** 551.521.3:551.551

Brunt, David, **The transfer of heat by radiation and turbulence in the lower atmosphere.** *Royal Society of London, Proceedings, A*, 124:201–218, 1929. **DLC**—In this paper the author shows that the outward flux of heat by radiation can be represented by $-k\frac{\partial T}{\partial z}$ calories/cm²/min, when $k=115/p_w$ at a temperature of 275°A, $p_w$ being the vapor pressure in mb and $T$ the absolute temperature at height z above ground. The average amount of incoming radiation which has to be disposed of is 0.275 calories/cm²/min which is the average over all latitudes and over day and night. *Subject Headings:* **1. Turbulent transfer of heat 2. Radiation balance.**—*From author's abstract.*

**4B–53** 551.551

Ertel, Hans, **Die Richtungsschwankung der horizontalen Windkomponente im turbulenten Luftstrom.** [Oscillations in direction of the horizontal wind component in a turbulent air stream.] *Beiträge zur Geophysik*, 23:15–21, 1929. 2 figs., ref., 8 eqs. **DLC**—The law of distribution of direction of the horizontal velocity component in turbulent wind is deduced from Hesselberg-Björkdal law of distribution of wind unrest (*see* 4B–54 below), and an expression for the mean direction oscillations is established. *Subject Headings:* **1. Wind structure 2. Atmospheric turbulence.**—*H.P.K.*

**4B–54** 551.551

Hesselberg, Th. and Björkdal, E., **Über das Verteilungsgesetz der Windunruhe.** [On the law of distribution of wind irregularity.] *Beiträge zur Physik der freien Atmosphäre*, 15:121–133, 1929. 6 figs., 6 tables, refs., 14 eqs. **DWB**—The author shows that assuming a steady mean velocity, constant rate of isotropic turbulence and a sufficiently long observation period, the frequency distribution of the additional velocities due to turbulence can theoretically be described by the Maxwell distribution law. Experimental results show fair agreement, deviations being explained by changes in the mean velocities during the observations. *Subject Headings:* **1. Turbulence statistics 2. Gustiness.**—*A.A.*

**4B–55** 551.551 551.524.4

Johnson, Sir Nelson K., **A study of the vertical gradient of temperature in the atmosphere near the ground.** *Great Britain. Meteorological Office, Geophysical Memoirs*, No. 46, 1929. 32 p., 21 figs., 12 tables, eqs. **DWB**—An early investigation of vertical temperature gradients near the ground including description of the platinum resistance thermometers used and continuous records of air temperature at a height of 1.2 m, differences in temperature over the intervals of height 1.2 m to 7.1 m and 1.2 m to 17.1 m. Detailed consideration given to diurnal variation of gradient and change of this variation throughout the year. Relations of gradients and cloudiness pointed out. *Subject Heading:* **1. Temperature profiles.**—*M.P.K.*

**4B–56** 551.551

Köhler, Hilding, **Über den Austausch zwischen Unterlage und Luft.** [Turbulent exchange between surface and air.] *Beiträge zur Geophysik*, 24:94–116, 1929. figs., 5 tables, eqs. **DWB**—It is shown that Stefan's evaporation law cannot be directly applied if turbulent transfer of water vapor is involved. Dependence of austausch coefficient on height and wind velocity and the cooling effect of mountains discussed. Solutions of the austausch differential equation for steady and unsteady cases studied. *Subject Headings:* **1. Austausch theory 2. Turbulent exchange 3. Evaporation 4. Orographic influences.**—*A.A.*

**4B–57** 551.551

Meier, A., **Turbulenzerscheinungen.** [Turbulence phenomena.] *Umschau*, Frankfurt a.M., 33(41):815–818, Oct. 12, 1929. 8 figs. **DLC**—A popular account of turbulence in its everyday manifestations such as ripples or sand dunes, diffusion of smoke in the air, and behaviour of water in a ship's wake. *Subject Heading:* **1. Turbulence effects.**—*M.P.K.*

**4B–58** 551.551

Schmidt, Wilhelm, **Die Struktur des Windes.** [The structure of the wind.] *Akademie der Wissenschaften, Vienna, Math.-Naturw. Klasse, Sitzungsberichte*, 138(2a):85–116, 1929. 9 figs., 3 tables, fold. chart. **DWB**—Microstructure of wind over different terrain (grass, water, fields) measured by means of moving pictures, using wind vanes. Cross sections of wind velocities are given. Regular eddies were seldom observed even at a great intensity of turbulence. Vertical distribution of wind velocity and exchange coefficient discussed. *Subject Headings:* **1. Atmospheric turbulence 2. Wind structure.**—*A.A.*

4B–59 551.551

Wagner, A., **Theorie der Böigkeit und der Häufigkeitsverteilung von Windstärke und Windrichtung.** [Theory of gustiness and the frequency distribution of wind strength and direction.] *Beiträge zur Geophysik*, 24:386–436, **1929.** 10 figs., 18 tables, 39 eqs. **DWB**—The author derives the Maxwell distribution law for turbulent horizontal wind velocities without mean motion and a combined law with cylinder functions for isotropic turbulence with mean motion. A better agreement with observational results can be obtained, assuming anisotropic turbulence (the spread of turbulent velocities is greater in the direction of mean motion than across it). Further discussion is devoted to the case, when the great axis of the spread eclipse does not coincide with the direction of the mean motion. The distribution law for wind directions is derived. An attempt is made to apply the theoretical results to the frequency distributions of hourly mean values of wind direction and velocity in Vienna. *Subject Headings:* **1. Wind structure 2. Gustiness 3. Vienna, Austria.**—*A.A.*

1930

4B–60 551.521.3:551.551

Brunt, David, **Some phenomena connected with the transfer of heat by radiation and turbulence in the lower stratosphere.** *Royal Society of London, Proceedings, Ser. A*, 130(812):98–104, Dec. **1930.** table, refs., eqs. **DLC**—The author extends his calculations of the previous year (*see* 4B–52 above). Of the .509 calories/cm²/min incoming radiation (for 270°A), .290 cal leaves the ground as outgoing radiation. If the lapse rate is 0.29, the radiation will balance. If more, the surface cools and the lapse rate is reduced. Maximum lapse rates may reach 1000 times dry adiabatic in hot sun. Without turbulence a maximum rate can be calculated. With turbulence it is more difficult. The author derives an equation for calculating the depth of heated air that can be heated (or cooled at night) by turbulence and radiation in time, $t$. $z = \sqrt{4K_R t} = 50\sqrt{t}$ cm. This formula gives results in accord with empirical data of Nelson and Johnson and others. *Subject Headings:* **1. Turbulent transfer of heat 2. Vertical temperature gradient.**—*M.R.*

4B–61 551.551

Ertel, Hans, **Eine Methode zur Berechnung des Austauschkoeffizienten aus den feinregistrierungen der turbulenten Schwankungen.** [A method for calculation of the austausch coefficient using detailed records of turbulent oscillations.] *Beiträge zur Geophysik*, 25:279–289, **1930.** 1 refs., 19 eqs. **DLC**—Similarity shown between the oscillations of properties of the turbulent air stream and the vertical gradient of these properties. Method developed for computing austausch coefficient based on detailed records of turbulent oscillations. *Subject Headings:* **1. Turbulent exchange 2. Turbulence statistics.**—*H.P.K.*

4B–62 551.551

Richardson, Lewis F. and Gaunt, J. Arthur, **Diffusion regarded as compensation for smoothing.** *Royal Meteorological Society, Memoirs*, 3(30):171–175, Dec. **1930. DWB**—Atmospheric motions may be studied in detail or smoothed by averaging, which may be over the whole of a spreading cluster, over a long time, mean of components relative to the isobar, or over a fixed or movable cell and the form of the law of diffusion depends entirely on the method of averaging. Observations of pairs of particles are likely to be fruitful. *Subject Heading:* **1. Turbulent diffusion.**—*C.E.P.B.*

4B–63 551.551

Scrase, F. J., **Some characteristics of eddy motion in the atmosphere.** *Great Britain. Meteorological Office, Geophysical Memoirs*, 6(52), **1930.** 16 p. 12 figs., 7 tables, 18 refs., eqs. **DWB**—"Experiments and analyses are carried out to gather information on the magnitudes of the components of eddy velocity and the frequency of occurrence of eddies" in the frictional layer. Eddy energy is found to be distributed anisotropically. Author shows that the non-isotropic condition at the surface tends to change to a more nearly isotropic condition at greater heights. *Subject Headings:* **1. Atmospheric turbulence 2. Anisotropic turbulence.**—*M.P.K.*

4B–64 551.551

*Takaya, Shizuma, **On the coefficient of eddy viscosity in the lower atmosphere.** *Kobe. Imperial Marine Observatory, Memoirs*, 4(1):1–29, **1930.** 3 figs., 9 tables, refs., 58 eqs. **DWB**—An attempt to give numerical values to the variation of the coefficient of eddy viscosity in the lower atmosphere. This variation may explain the disagreement between theoretical and observed values for the distribution of wind with height. *Subject Headings:* **1. Turbulence in the frictional layer 2. Eddy viscosity 3. Wind profiles.**—*M.P.K.*

## 1931

**4B–65** 551.551

Davies, E. Ll. and Sutton, O. G., **The present position of the theory of turbulent motion in the atmosphere.** *Royal Meteorological Society, Quarterly Journal,* 57(242):405–511, **1931.** 16 refs., eqs. **DLC**—Previous research on eddy motion in the atmosphere is reviewed briefly, and the status of knowledge on transfer of momentum, heat and matter (smoke, volcanic ash and balloons). The latest advance was RICHARDSON's "distance neighbor graph" which attempted to formulate the tendency of particles to be caught in larger and larger eddies as time goes on. But later (1929) he tried to show that no differential equation could represent the processes of diffusion in a turbulent atmosphere. Topographical effects cannot solely account for turbulence since air masses of different origin have different degrees of turbulence when flowing over the same ground. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulent diffusion 3. Atmospheric eddies.**—*M.R.*

**4B–66** 551.551

Mildner, P., Hänsch, F. and Griessbach, K., **Doppelvisierungen von Pilotballonen zur Untersuchung von Turbulenz und Vertikalbewegungen in der Atmosphäre.** [Double theodolite pilot balloons for the investigation of turbulence and the vertical motions in the atmosphere.] *Beiträge zur Physik der freien Atmosphäre,* 17:181–219, **1931.** 14 figs., 2 tables, 15 refs., 8 eqs. **DWB**—Wind direction and speed were measured by means of balloons during one day at short time intervals up to 1800 m. The results are presented in isoplets (height vs. time for direction, speed and air resistance), which characterize the irregular motion of the air. A detailed discussion of possible sources of errors using theodolite and a discussion of the influence of the air resistance on the ascent velocity is given. *Subject Headings:* **1. Atmospheric turbulence 2. Gustiness 3. Theodolite observations.**—*A.A.*

**4B–67** 551.511:551.551

Taylor, Geoffrey Ingram, **Effect of variation in density on the stability of superposed streams of fluid.** *Royal Society of London, Proceedings, Ser. A,* 132(820):499–523, **1931.** 10 figs., 2 tables, 39 eqs. **DLC**—An elaborate piece of work performed by the author in 1914, but hitherto unpublished, is described in detail in this article. An attempt is made to show how the great density difference which occurs under stable conditions such as occur at night allows a great velocity gradient to be maintained. Turbulence is suppressed or greatly reduced by the density gradient. Equations are solved and an attempt made to interpet the solutions. *Subject Headings:* **1. Turbulence theory 2. Wind profiles 3. Density gradients 4. Stability.**—*M.R.*

## 1932

**4B–68** 551.554 551.551

Barkat, Ali, **Variation of wind with height.** *Royal Meteorological Society, Quarterly Journal,* 58(245):285–288, **July 1932.** 2 figs., table. **DWB**—From observations at 1.7 and 21.7 m at Agra, the diurnal variation of $a = \log(V_2/V_3)/\log(h_2/h_3)$ is plotted for three seasons and compared with lapse rate of temperature. Observations at 21.7 m are also compared with 200 m and $(a\text{-}0.46)/\mu$ found to be nearly constant ($\mu$ = coefficient of eddy viscosity). *Subject Heading:* **1. Wind profiles.**—*C.E.P.B.*

**4B–69** 551.551:551.524.4

Ertel, Hans, **Die Abhängigkeit des Turbulenzkoeffizienten von der vertikalen Temperaturverteilung.** [Dependence of turbulence coefficient on the vertical temperature distribution.] *Beiträge zur Geophysik,* 35:291–294, **1932.** 3 refs., 15 eqs. **DWB, DLC**—Attempt made to prove theoretically the dependence of eddy viscosity on the lapse rate of the temperature empirically stated by F. M. EXNER. *Subject Headings:* **1. Turbulence theory 2. Eddy viscosity.**—*H.P.K.*

**4B–70** 551.551:551.54:551.43

Ertel, Hans, **Turbulenz und Druckerniedrigung auf Bergstationen.** [Turbulence and pressure decrease at mountain stations.] *Meteorologische Zeitschrift,* 49:199–201, 360, **1932.** fig., 6 eqs. **DWB**—Further remarks on the theory presented by the author and the criticism by KOSCHMIEDER in regard to the effect of turbulence and laminar flow on the pressure at a mountain observatory as compared with static pressure in the free air. Reply by KOSCHMIEDER, p. 359. Rebuttal by ERTEL, p. 360. *Subject Headings:* **1. Atmospheric turbulence 2. Mountain meteorology 3. Atmospheric pressure. I. Koschmieder, Harald.**—*M.R.*

**4B–71** 551.551:551.554

*Giblett, M. A. and others, **The structure of wind over level country. Report on experiments carried out at the Royal Airship Works, Cardington.** *Great Britain. Meteorological Office, Geo-*

*physical Memoirs*, 6(54), **1932.** 119 p. 93 figs., 28 tables, appends. **DLC**—A comprehensive treatise presenting masses of data and reproduction of numerous records as well as analysis of data and theoretical developments. Anemographs were fitted with drums that revolved once every 10 minutes (144 times as fast as usual) in order to study the structure of the wind with respect to small eddies. Two types of traces were observed—the first under conditions of lapse of temperature, when gusts and lulls of all types were recorded, and the second under inversion conditions when gusts were absent even under increased wind speed conditions. Gusts due to surface friction are distinguished from a convectional eddy motion which is thought to be cellular. Work begun in 1925 at Cardington, using Dines anemometers and thermometers on high masts for comparison with conditions lower down, is described, illustrated and discussed. Results of observations with various combinations of instruments and speeds of records are fully presented. Relation of wind structure to temperature at various levels, lapse rates, humidity, rainfall, sunshine and other factors shown graphically for 2 types of eddies. Frequency distribution of accelerations, veering and backing of wind, and of duration of gusts compared. Relation of surface wind to wind at 50 ft, eddy energy and eddy pressure, effects of fronts and squalls, etc. discussed and illustrated, and rules for aid of aeronautics personnel formulated. A section by C. S. DURST on the theory of eddies, based on studies of BENARD, RAYLEIGH, LOW and BRUNT and TERADA, shows similarity between thermal atmospheric eddies and Benard cells in fluids, using cloud pattern and sketches made from above wind studies as evidence. Ratio of wind at 150 ft to that at 50 ft and to gradient winds also treated. Theory of turbulence presented and values of $K$ for various tests computed with respect to temperature gradient and wind speed. *Subject Headings:* **1. Turbulence theory 2. Gustiness 3. Wind profiles 4. Convective cells 5. Cardington, England. I. Durst, C. S.**—*M.R.*

**4B–72** 551.551

Köhler, Hilding, **Ein kurzes Studium des Austausches auf Grund des Potenzgestzes.** [Short study of exchange on the basis of the power law.] *Beiträge zur Physik der freien Atmosphäre*, 19:91–104, **1932.** 6 figs., 2 tables, 16 refs., 19 eqs. **DLC**—Author derives a power law for vertical distribution of wind velocity, assuming $A = A_1 Z^{\frac{p}{p+1}}$, applies the theory to the vertical propagation of a temperature wave and compares the results with the assumption of a constant coefficient of exchange. *Subject Headings:* **1. Wind profiles 2. Exchange coefficient 3. Diurnal temperature variations.**—*A.A.*

**4B–73** 551.551:551.511

Rossby, Carl-Gustav, **A generalization of the theory of the mixing length with applications to oceanic and atmospheric turbulence.** *Massachusetts Institute of Technology, Meteorological Papers*, 1(4), **1932.** 36 p. 2 figs., 2 tables, 27 refs., 180 eqs. **DWB**—A clear and logical development of the turbulence theory of REYNOLDS, PRANDTL and VON KÁRMÁN, with an extension to cover the condition of kinematic similarity followed by formulation of the restriction imposed upon the mean motion due to the Coriolis force, application to pure drift currents (EKMAN) and finally, application to austausch and grossaustausch in the earth's atmosphere (SVERDRUP, TAYLOR and others). *Subject Headings:* **1. Turbulence theory 2. Mixing length 3. Oceanography 4. Atmospheric turbulence.**—*M.R.*

**4B–74** 551.551

Sherlock, R. H. and Stout, M. B., **Picturing the structure of the wind.** *Civil Engineering*, Easton, Pa., 2(6):358–363, June **1932.** 5 figs., photos. **DLC**—A steel experimental wind tower 250 ft high and ten 50 ft wooden towers spaced 60 ft apart were installed on a ridge near Ann Arbor, Mich., with an axis normal to prevailing storm winds. Special pressure plate anemometers were designed to give more detailed data on structure of gusts than is possible with Robinson type anemometers. The plates had a maximum movement of .005 inches, a response of .12 sec and a natural frequency of 115 cycles/sec. With this setup it was possible to get a horizontal section of a gust at 50 ft and at 60 ft height intervals over a 660 ft front and a vertical section with readings every 50–250 ft elevation. Elaborate vertical and horizontal time cross sections presented here show lines of iso-velocity indicating the fine structure of gusts. The results are interpreted so as to give a theoretical picture of air flow in the presence of gusts and the consequent pressure or loads on lines or structures. *Subject Headings:* **1. Turbulence measurement 2. Wind structure 3. Gustiness 4. Anemometers 5. Ann Arbor, Michigan.**—*M.R.*

**4B–75** 551.551

Sutton, O. G., **A theory of eddy diffusion in the atmosphere.** *Royal Society of London, Proceedings, Ser. A*, 135(826):143–165, Feb. **1932.** 7 figs., 2 tables, 15 refs., 16 eqs. **DLC**—A nice attempt at defining a coefficient for eddy diffusion which would not vary as previous coefficients had done (from $10^2$ to $10^{11}$ $cm^2$/sec for various sizes of eddies), since it is the author's belief that the size of

an eddy can vary as time passes (as in the scatter of a cluster of balloons or of smoke from a continuous point source). The theory is developed and experiments with diffusion over great distances (balloons) or short distances (smoke) described, tabulated and plotted to show that the Fickian law does not hold, but that eddies increase in size, even at great heights (antiaircraft bursts up to 5450 m). Application to prediction of cyclonic eddies (DEFANT) suggest further need to consider time factor in formulas for wind distribution over Europe. *Subject Headings:* **1. Atmospheric eddies 2. Smoke diffusion.**—*M.R.*

**4B–76** 551.551 551.511

Sverdrup, Harald Ulrik, **Wärmehaushalt und Austauschgrösse auf Grund der Beobachtungen der "Maud" Expedition.** [Heat economy and magnitude of exchange on the basis of the observations of the "Maud" Expedition.] *Beiträge zur Physik der freien Atmosphäre*, 19: 276–290, **1932.** 5 figs., 5 tables, 12 refs., 10 eqs. **DLC**—The observations made on the "Maud" Expedition are considered ideal for determining the austausch coefficient under various conditions of stability, since detailed measurements were made of temperature under and in the first few meters above the ice or snow, and the wind, humidity, cloudiness and other conditions are known. Calculations are made and shown in tables and graphs, of the austausch coefficient $\eta$ for different cloud amounts and temperature gradients and as a function of wind speed. The values of $\eta$ are greater for cloudy than for clear days and for high than for low wind speeds. Individual soundings are analyzed and typed according to austausch degree and stability. *Subject Headings:* **1. Turbulent exchange 2. Stability 3. "Maud" Expedition 4. Arctic.**—*M.R.*

**4B–77** 551.551

Ziemer, Gerhard, **Über die Böigkeit des Windes in Bodennähe.** [On the gustiness of the wind near the ground.] *Beiträge zur Physik der freien Atmosphäre*, 18(4):263–342, **1932.** 19 figs., tables, refs., append. **DLC**—Gives definitions of gustiness characteristics, presents results of observations of the dependence of gustiness on wind velocity, wind direction, temperature gradient, air masses and discusses urban and mountain influences. Gustiness has a definite diurnal variation. *Subject Headings:* **1. Gustiness 2. Diurnal gustiness variations 3. Urban influences.**—*A.A.*

## 1933

**4B–78** 551.551:551.511

Ertel, Hans, **Beweis der Wilh. Schmidtschen konjugierten Potenzformeln für Austausch und Windgeschwindigkeit in den bodennahen Luftschichten.** [Evidence of Wilhelm Schmidt's integrated dynamic formula for austausch and wind speed in the air layers near the ground.] *Meteorologische Zeitschrift*, 50:386–388, **1933.** ref., 6 eqs. **DWB**—Brief contribution in which author proves that in lower layers of atmosphere the horizontal turbulent shearing stress, defined as vertical austausch coefficient times vertical gradient of mean velocity, is to a high degree of approximation independent of height. Treatment is based on the assumption of the isotropy of the coefficient of vertical turbulent momentum interchange, and final result depends on the relative smallness of the variation of wind direction with height in the surface layers. *Subject Headings:* **1. Wind profiles 2. Power law 3. Turbulent transfer of momentum. I. Schmidt, Wilhelm.**—*H.P.K.*

**4B–79** 551.551 533.607

Field, J. H. and Warden, R., **A survey of the air currents in the Bay of Gibraltar, 1929–1930.** *Great Britain. Meteorological Office, Geophysical Memoirs*, 7(59), **1933.** 30 p. 3 figs., 31 plates, 5 tables. **DWB**—A very detailed examination was made of the eddies caused by the Rock of Gibraltar, using first a model in a wind tunnel, and then with pilot balloons on the spot. The results are presented in a number of plates showing the pitch and yaw on grids at different heights and diagrams of the air flow. The winds are turbulent for 2+ miles to lee of the Rock up to 5000+ ft, with vortices up to 6000 ft diameter and vertical velocities up to 1500 ft/min. Turbulence is also illustrated by photos of Levanter cloud. A kite instrument for recording eddies is described. *Subject Headings:* **1. Atmospheric turbulence 2. Orographic effects 3. Gibraltar.**—*C.E.P.B.*

**4B–80** 551.551 551.507.321.2

Lettau, Heinz and Schwerdtfeger, Werner, **Untersuchungen über atmosphärische Turbulenz und Vertikalaustausch vom Freiballon aus. I, II, III Mitteilungen.** [Investigation of atmospheric turbulence and vertical austausch from a free balloon. Reports I, II, III.] *Meteorologische Zeitschrift*, 50(7):250–256, July **1933.** figs., 6 refs., eqs. *Ibid.*, 51(7):249–257, July **1934.** 5 figs., 9 refs. *Ibid.*, 53(2):44–53, Feb. **1936.** figs., refs., tables, eqs. **DWB**—In parts I and II the results of measurements of the vertical component of the wind in the free atmosphere and derived values for austausch are reported. Part III contains the description of and results from three later ascents, two made during the daytime in summer radiation weather and the other on a relatively calm October night. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulence measurement 3. Sounding balloons.**—*M.P.K.*

**4B–81** 551.551

*Mildner, P., **Über die Turbulenz des Windes, beobachtet mit Hilfe von doppelt und einfach visierten Pilotballonen.** [On the turbulence of wind observed by means of the double and single pilot balloons.] *Beiträge zur Physik der freien Atmosphäre*, 20(2):144–126, **1933.** 6 figs., 6 tables 9 refs., eqs. **DLC, DWB**—Results of a series of 28 double and 54 single theodolite observations o balloons on Oct. 20, 1931 at Leipzig Airport to determine the small scale three-dimensional motion of the air. Charts show isopleths of wind direction, speed and vertical motion (ascension rate o pilot balloons) during the course of the day (9 A.M. to 4 P.M.) for heights up to 700 m. *Subject Headings:* **1. Turbulence in the frictional layer 2. Wind structure 3. Sounding balloons 4. Leipzig Germany.**—*M.R.*

**4B–82** 551.551

*Möller, Fritz, **Freie und erzwungene Turbulenz.** [Free and induced turbulence.] *Beiträg zur Physik der freien Atmosphäre*, 20(2):79–83, **1933.** 5 figs., table, ref. **DLC**—A summary of the study on the three-dimensional structure of the wind made by SCRASE on the basis of data for 1.5 m and 19 m elevation. The basic data are presented in summary tables and on graphs. *Subject Headings:* **1. Atmospheric turbulence 2. Vertical motion 3. Wind structure.**—*M.R.*

**4B–83** 551.551

Roberts, O. F. T., **On the functional equation of eddy-diffusion.** *Royal Meteorological Society Memoirs*, 4(37):85–97, April **1933.** 31 eqs. **DWB**—From the equation expressing the density of matter in an atmosphere of homogeneous (but not necessarily isotropic) diffusing power, it i shown that the square of the specific density of matter scattered from a plane source varies with time This is extended to show how eddy diffusion may differ from thermal diffusion in a solid. The result is extended to homogeneous scattering in 3 dimensions and to scatter from a fixed point o line into a medium with uniform mean flow. *Subject Heading:* **1. Turbulent diffusion.**—*C.E.P.B.*

## 1934

**4B–84** 551.551:551.524.

Haude, Waldemar, **Temperatur und Austausch der bodennahen Luft über einer Wüste.** [Tem perature and exchange of the air near the ground over a desert.] *Beiträge zur Physik der freien Atmosphäre*, 21:192–142, **1934.** 8 figs., 10 refs. **DWB**—Observations of temperature oscillations made in the Gobi Desert for the heights 0.1–0.2, 1, 8, 25, 100, [200, 600] cm. Results graphically represented and interpreted as exchange phenomena. *Subject Headings:* **1. Temperature micro oscillations 2. Boundary layer 3. Micrometeorological turbulence, 4. Gobi Desert, China.**—*A.A*

**4B–85** 551.551

Sakuraba, S. and Kimura, I., **Turbulent motions in the atmosphere (1st and 2nd paper).** *Geophysical Magazine*, Tokyo, 8:125–151, **1934;** 9:11–21, **1935.** figs., tables, refs., eqs. **DWB**—Using Lindenberg aerological data, the author recomputes the coefficients of eddy viscosity which S. TAKAYA worked out on the basis of the momentum transfer theory of PRANDTL, to take into consideration theoretical concepts of G. I. TAYLOR (vorticity transfer). The equations are developed at great length, the final equation which the author adopts being $\eta = \eta_0(1 \pm \sigma z)$ for distribution of vertical viscosity and $\eta = \eta_0(1 \pm \sigma z)^2$ for distribution of viscosity with height. Calculations are made from DOBSON's data for morning and midday in spring and summer respectively. It was found that the increment $\sigma$ is larger and the coefficient $\eta_0$ at the ground smaller than TAKAYA obtained when pilot balloon data for ascents at Kasumigura were used. In the second paper the distribution of wind speed with height is worked out according to the Taylor theory and the results compared with those of TAKAYA. It is concluded that the distribution of wind speed during light surface winds and in early morning in spring follows the exponential law near the ground, but with moderate winds and in summer, the coefficient remains constant with height. *Subject Headings:* **1. Eddy diffusivity 2. Vorticity transfer theory. I. Takaya, S.**—*M.R.*

**4B–86** 551.551 551.573

Sutton, O. G., **Wind structure and evaporation in a turbulent atmosphere.** *Royal Society of London, Proceedings, Ser. A*, 146:701, **1934.** fig., refs., 21 eqs. **DLC**—Theoretical article in which a theory of the transfer of momentum and mass in a turbulent medium is developed, elaborated, and extended to the problem of evaporation, on the assumption that the diffusion of mass follows the same laws as the diffusion of momentum. (*Same item as* K–45, Nov. 1950, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Evaporation 3. Wind structure.**

## 1935

**4B–87** 551.558:551.588.7

Albrecht, Fritz and Grunow, Johannes, **Ein Beitrag zur Frage der vertikalen Luftzirkulation in der Grosstadt.** [A contribution to the question of the vertical air circulation in a large town.]

*Meteorologische Zeitschrift*, 52:103–108, **1935.** 7 figs., table. **DWB**—Extensive synoptic observations were undertaken in Berlin. Novel instrument equipment is described and illustrated, vertical sections of wind and variability of temperature and some specimen records shown. A unit, the "Stodieck" Number (after K. STODIECK), representing the vertical air exchange, is described and its relation to wind speed over roofs shown. It was found that the dynamic effect of light winds was sufficient to mask the thermal effects in the streets, but in courtyards a pure thermal circulation occurred in the day (shown schematically in fig. 7). (*Same item as* 3G–148, July 1952, *MAB.*) *Subject Headings:* **1. Urban climatology 2. Wind structure 3. Berlin, Germany.**—*C.E.P.B.*

**4B–88** 551.511:551.551

Best, A. C., **Transfer of heat and momentum in the lowest layers of the atmosphere.** *Great Britain. Meteorological Office, Geophysical Memoirs*, 7(65), **1935.** 66 p. 32 figs., 35 tables, 18 refs. **DWB**—Pt. I discusses gradients of temperature between 2.5 and 30 cm and 30 cm—1.2–7.1–17.1 m over short grass and deduces the coefficient of eddy conductivity (mean values range from 2.17 cm²/sec. 2.5–30 cm to 4940 7.1–17.1 m). Log $K$ against log $ht$ gives a straight line. Pt. II deals with vertical gradient of wind velocity 2.5 cm–5 m obtaining a linear function of log (-const.) or a power law (index 0.13–0.43). Pt. III considers wind fluctuations in the mean direction as measured by a hot wire anemometer and finds that near the ground the frequency distribution of different magnitudes is given by the normal error curve. Finally, Pt. IV discusses the lateral and vertical components of gustiness in the lowest 5 m, using two small universally pivoted vanes, and a number of conclusions are reached. *Subject Headings:* **1. Micrometeorological turbulence 2. Turbulent transfer of heat 3. Turbulent transfer of momentum.**—*C.E.P.B.*

**4B–89** 551.551 533.16

Kuethe, Arnold M., **The scale of the boundary layer in the atmosphere.** *Journal of the Aeronautical Sciences*, 2:115–117, May **1935. DLC**—An attempt is made to show the applicability of boundary layer techniques used in wind tunnels to study the conditions in the turbulent atmosphere near the ground. The author has examined pilot balloon ascent records for Akron, Ohio and found that in 50% of the cases there is a well-defined "boundary layer" from 200 to 1000 m thick. These records are analyzed for determination of the frequency of velocity fluctuations at 50 feet above the ground with respect to the velocity at the outer edge of the boundary layer ($u_0$) and the thickness of that layer ($\delta$). It was found that frequency ($n$) counts cluster around a modal value of 16 per hour, and $B$ around $B=6$ where $(B=u_0/n\delta)$. *Subject Headings:* **1. Atmospheric turbulence 2. Friction layer 3. Wind fluctuations 4. Akron, Ohio.**—*M.R.*

**4B–90** 551.511 551.465

Rossby, Carl-Gustav, and Montgomery, R. B., **The layer of frictional influence in wind and ocean currents.** *Papers in Physical Geography and Meteorology*, Cambridge, Mass., 3(3), **1935.** 101 p. 44 figs., 32 tables, 48 refs., 207 eqs., append. **DWB**—An attempt is made to analyze "the principal factors controlling the mean state of turbulence and hence the mean velocity distribution in wind and ocean currents near the surface and to develop a quantitative theory for the eddy-viscosity coefficient in terms of controlling parameters" including gradient or surface (for ocean currents) wind velocity, roughness, stability and latitude. *Subject Headings:* **1. Boundary layer 2. Ocean-atmosphere interaction 3. Wind driven currents. I. Woods Hole Oceanographic Institution.**—*M.P.K.*

**4B–91** 551.551

Roux, Ludwig, **Turbulente Windströmungen auf der rauhen Erdoberfläche.** [Turbulent wind streams on the rough earth surface.] *Zeitschrift für Geophysik*, 11:165–187, **1935.** 18 figs., refs., 58 eqs. **DWB**—Highly theoretical work in which author states that the speed profile in a turbulent current can be calculated approximately by the logarithmic profile. *Subject Headings:* **1. Atmospheric turbulence 2. Wind profiles.**—*H.P.K.*

**4B–92** 551.551

Schlichting, Hermann, **Turbulenz bei Wärmeschichtung.** [Turbulence and heat stratification.] *Zeitschrift für angewandte Mathematik und Mechanik*, 15(6):313–338, Dec. **1935. DLC.** Translation by J. Vanier. *U. S. NACA, Technical Memorandum* 1262, Oct. **1950.** 55 p. 15 figs., 5 tables, 26 refs., 45 eqs. **DLC**—Observations of nocturnal stability phenomena in nature, Richardson and Taylor's observations on gustiness under various conditions of stability and other meteorological phenomena related to laminar or turbulent flow led to the present investigation of the stability of a stratified plane laminar boundary layer in the laboratory. The history of such research is clearly outlined, the general perturbation equations solved, for the frictionless case and for a turbulent boundary layer. Theoretical tables and curves are compared with experimental. It was concluded that the flow becomes more stable as the Richardson number increases up to a critical value where the

flow is stable for all wave lengths and Reynolds numbers. *Subject Headings:* **1. Turbulence theory 2. Boundary layer 3. Temperature stratification 4. Translations. I. Vanier, J.** (*trans.*).—*M.R.*

## 1936

**4B–93** 551.573:551.55

Dörffel, K. and Lettau, Heinz, **Der Wasserdampfübergang von einer nassen Platte an strömende Luft.** [Water vapor transfer from a wet plate to an air stream.] *Annalen der Hydrographie und Maritimen Meteorologie*, 64:342–352, 504–510, **1936.** 9 figs., 10 tables, 21 refs., eqs. **DLC**—A technical article on the measurement of evaporation and related problems of heat exchange. The necessity of including the fetch or length of air trajectory over the moist surface in calculations of evaporation and moisture transport, is brought out. Size of evaporation reservoir is, therefore, of prime importance in instrumentation. Applications to problems of micro- and bioclimatology, as well as to synoptic and marine observations and to energy exchange studies over the continents and oceans, considered. *Subject Headings:* **1. Evaporation 2. Turbulent transfer of moisture 3. Energy exchange.**—*M.R.*

**4B–94** 551.55

*Doporto, Mariano, **El coeficiente de turbulencia y la variación del viento con la altura sobre Madrid.** [The coefficient of turbulence and the variation of the wind with height over Madrid.] *Sociedad Española de Fisica y Quimica, Anales*, 34:298–303, **1936.** **DWB**—Results of about 500 pilot balloon soundings over Madrid (1915–1920) are analyzed in order to calculate the values of the coefficient of turbulence for levels from the ground to 2600 m at three times during the day. Values of $K$ are computed for the layer 25–75 m above the ground as (2.8, 5.3 and 4.3) $\times 10^4$ cgs for 7, 11 and 16 h, respectively. *Subject Headings:* **1. Turbulence in the frictional layer 2. Wind profiles 3. Eddy diffusivity 4. Madrid, Spain.**—*M.R.*

**4B–95** 551.524.

Fritzch, Gerhard and Stange, Rudolf, **Vertikaler Temperaturverlauf über einer Grosstadt** [Vertical temperature lapse rate over a large city.] *Beiträge zur Physik der freien Atmosphäre* 23:95–110, **1936.** 15 figs., tables, 5 refs., eqs. **DWB**—From continuous air temperature records at 80, 50, 35, 25 and 4 m above the ground in Leipzig, the coefficient of austausch was calculated by Ertel's method. *Subject Headings:* **1. Atmospheric turbulence 2. Exchange coefficient 3. Urban climatology 4. Leipzig, Germany.**—*M.P.K.*

**4B–96** 551.508.5 551.55

Gold, E., **Wind in Britain; the Dines anemometer and some notable records during the last 40 years.** *Royal Meteorological Society, Quarterly Journal*, 62(264):167–206, April **1936.** 30 figs. 5 tables, 18 eqs. **DLC**—Describes Dines pressure tube anemometer and distant-reading apparatus and distribution of these records in British Isles. A number of records are reproduced illustarting gustiness in different exposures—London, Gibraltar, Lizard, Bell Rock, etc.—effect of buildings and other obstacles on gustiness and some extreme gusts. *Subject Headings:* **1. Gustiness 2. Turbulence measurement 3. Pressure anemometers 4. British Isles.**—*C.E.P.B.*

**4B–97** 551.55

Haurwitz, Bernhard, **The daily temperature period for a linear variation of the Austausch coefficient.** *Royal Society of Canada, Transactions, 3rd Ser., Section III*, 30:1–8, May **1936.** 3 figs. 2 tables, refs., eqs. **DLC**—The author integrates the austausch equation, assuming a linear increase of the austausch coefficient ($A$) with height ($z$). The amplitude and retardation of the daily temperature wave at different levels is compared with the results assuming $A$ to be constant. The amplitude decreases and the retardation increases much more with height using the author's equation. A convenient method of computing the coefficient $A$ is proposed and a table for calculation purposes added. The Eiffel tower observations give the result:

$$A = 9.42\ (1 + .407 \times 10^{-4} z) \text{ in cgs. units.}$$

*Subject Headings:* **1. Diurnal temperature variations 2. Exchange coefficient.**—*A.A.*

**4B–98** 551.55

Sutton, O. G., **The logarithmic law of wind structure near the ground.** *Royal Meteorological Society, Quarterly Journal*, 62(263):124–127, **1936.** 3 tables, 6 refs., 4 eqs. Sverdrup, H. U., **Note on the logarithmic law of wind . . .** *Ibid.*, p. 461–462. 3 refs. Reply by Sutton, *ibid.*, 63(268):105–107, **1937.** **DLC**—SUTTON compares the more universal logarithmic law with the simpler power law, discusses physical meaning of parameters included and agreement with observations. SVERDRUP discusses the logarithmic law under adiabatic conditions according to ROSSBY and MONTGOMERY using surface roughness as parameter while SUTTON involved degree of turbulence. The power law has the character of an interpolation formula for inversions. Sutton replies that two series of

experiments justify the use of his turbulence parameter. *Subject Headings:* **1. Wind profiles 2. Roughness parameter. I. Sverdrup, Harald Ulrik.**—*A.A.*

**4B–99** 551.551

Sverdrup, Harald Ulrik, **Austausch und Stabilität in den untersten Luftschichten.** [Austausch and stability in the lower layers of the atmosphere.] *Meteorologische Zeitschrift*, 53(1):10–15, Jan. **1936.** 4 figs., 2 tables, 5 refs., 26 eqs. **DWB**—The theories of PRANDTL (1932) and of ROSSBY and MONTGOMERY (1935) are reviewed and applied to the problem of determining the austausch coefficient over a surface with small or moderate roughness when the wind and temperature distribution are known accurately and can be represented by a logarithmic law. Empirical tables and diagrams are presented to show how the constants behave under different lapse rates. $K_0 = 0.38$ and $B = 11.0$. Conclusion is that the lapse rate depends only on austausch and not on radiation conditions in the surface layers. Results applicable to exchange over sea when vapor pressures are small. *Subject Headings:* **1. Turbulent exchange 2. Stability. I. Prandtl, L. II. Rossby, C.-G. III. Montgomery, R. B.**—*M.R.*

**4B–100** 551.551

*Sverdrup, Harald Ulrik, **The eddy conductivity of the air over a smooth snow field. (Results of the Norwegian-Swedish Spitsbergen Exped. in 1934).** *Geofysiske Publikasjoner*, Oslo, 11(7), **1936.** 69 p. 17 figs., 8 tables, refs., eqs. **DLC**—Observations taken on Isachsen's Plateau on West-Spitsbergen, lat. 79°09′N, long. 12°56′E Gr. at an altitude of 870 m above sea level are tabulated and used as the basis of a study of the conduction of heat and water vapor in the layer directly above the ground. Both eddy convectivity and eddy conductivity are shown to vary with increasing distance from the boundary surface and to depend on wind velocity, surface roughness and stability of stratification. *Subject Headings:* **1. Boundary layer 2. Turbulent transfer of heat 3. Evaporation of snow 4. Isachsen's Plateau, Spitsbergen.**—*M.P.K.*

**4B–101** 551.551

Sverdrup, Harald Ulrik, **Turbulensforskning i laboratoriet og i naturen.** [Turbulence investigations in the laboratory and in nature.] *Bergen, Norway. Chr. Michelsens Institutt för Videnskap og Åndsfrihet, Beretninger*, VI, No. 5, **1936.** 21 p. 3 figs., eqs. In Norwegian, English summary p. 19–20. **DWB**—Concepts of eddy or turbulent motion and exchange of mass between sea or land surface and air are outlined and importance for solution of technical or geophysical problems stressed. Until a short time previous to this paper, not much had been done to harmonize theoretical work, laboratory experiments and free air turbulence investigations. PRANDTL's mixing length concept was applied to free air conditions by ROSSBY and MONTGOMERY with some success. The author uses data from Norwegian-Swedish Svalbard Expedition of 1934 to obtain values for turbulent exchange of mass over a snow field. The work is further refined in the laboratory and applied to computation of evaporation over the Atlantic Ocean. Equations and nomograms given. *Subject Headings:* **1. Turbulent exchange 2. Evaporation from seas 3. Svalbard Expedition, 1934 4. Isachsen's Plateau, Spitsbergen.**—*M.R.*

## 1937

**4B–102** 551.511

Lettau, Heinz, **O. G. Suttons Theorie der Verdunstung in turbulenter Luft im Vergleich zu neueren Beobachtungen.** [O. G. Sutton's theory of evaporation in the turbulent air in comparison with more recent observations.] *Annalen der Hydrographie und Maritimen Meteorologie*, 65:155–160, **1937.** 8 refs. **DLC**—Critical discussion and development of theory enunciated by SUTTON (1934), based on more recent observational data than SUTTON had available (GALLENKAMP's measurements). Discussion consists mainly of definition of PRANDTL's "mixing length." (*Same item as* No. K–67, Nov. 1950, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Evaporation 3. Mixing length.**—*M.R.*

**4B–103** 551.573:551.554:551.571.4

Millar, F. Graham, **Evaporation from free water surfaces.** *Canada. Meteorological Service, Memoirs*, 1(2):43–65, **1937.** 9 figs., 6 tables, 16 refs., 9 eqs. **DLC**—Discussion of wind tunnel evaporation experiments from empirical point of view. Theory of turbulent mass exchange used to develop equations for evaporation from both finite and infinite free water surfaces. Formulas obtained are in agreement with principle of dynamic similarity and are claimed to be of more general application than the usual power laws, and are verified by the observational material for a wide range in the size of surface. In order to obtain good agreement between theory and experiment using treatment of eddy transfer developed by SVERDRUP, it was necessary to adjust the value of a constant in VON KÁRMÁN's expression for skin friction. (*Same item as* No. K–71, Nov. 1950, *MAB.*) *Subject Headings:* **1. Turbulent exchange 2. Evaporation.**—*H.P.K.*

**4B–104** 551.551

§Sherlock, R. H. and Stout, V. B., **Wind structure in winter storms.** *Journal of the Aeronautical Sciences*, 5(2):53–61, Dec. **1937.** 10 figs., 5 refs. **DLC**—Iso-velocity contours derived from anemometer observations taken during two winter storms near Ann Arbor, Mich., show detailed cross sections of passing gusts. Theoretical and observed turbulent flow are compared. *Subject Headings:* **1. Micrometeorological turbulence 2. Wind structure 3. Ann Arbor, Michigan.**—*M.P.K.*

## 1938

**4B–105** 551.551:551.573

Domingo Quílez, José, **Turbulencia atmosférica y evaporación.** [Atmospheric turbulence and evaporation.] *Spain. Servicio Meteorológico, Publicaciones, Ser. A, Memorias*, No. 9, **1938.** 39 p. 36 refs., 57 eqs. **DWB**—It is shown that the classical formulas of Dalton and Stefan cannot be used to determine the amount of water evaporated under natural conditions, but that concepts of turbulence and turbulent transfer of mass, based on TAYLOR's and RICHARDSON's work must be considered. The presentation is entirely theoretical, but covers all of the important developments along this line, up to 1937 (LETTAU and SUTTON). (*Same item as* No. K–84, Nov. 1950, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Turbulent diffusion 3. Evaporation 4. Turbulent transfer of moisture.**—*M.R.*

**4B–106** 551.551

Doporto, Mariano, **La turbulencia dinámica de la atmósfera en Barcelona.** [Dynamic turbulence of the atmosphere at Barcelona.] *Spain. Servicio Meteorológico Español, Publicaciones, Serie A, Memorias*, No. 10, **1938.** 44 p. 16 figs., 6 tables, eqs., bibliog., p. 44. English abstract, p. 3–4. **DWB**—A study of the vertical variation of the wind (due to macroturbulence produced by obstacles on the ground) in all the strata perturbed by the eddies, and its relation to the vertical temperature gradient. *Subject Headings:* **1. Atmospheric turbulence 2. Urban climatology 3. Barcelona, Spain.**—*From author's abstract.*

**4B–107** 551.551

Sverdrup, Harald Ulrik, **On the influence of stability and instability on the wind profile and the eddy conductivity near the ground.** *International Congress for Applied Mechanics, Cambridge, Mass. 1938, Proceedings*, p. 369–372, **1938.** 3 figs., refs., 23 eqs. **DWB**—Author discusses dependence of wind velocity, temperature and exchange coefficient on height and compares theoretical assumptions with observations made by BEST and his own observations on a snowfield (roughness parameter 0.25 cm). The author's formula for vertical wind variation gives better results for unstable and SUTTON's formula for stable cases. *Subject Headings:* **1. Wind profiles 2. Temperature profiles 3. Turbulent exchange.**—*A.A.*

## 1939

**4B–108** 551.551:551.554

Calder, K. L., **A note on the constancy of horizontal turbulent shearing stress in the lower layers of the atmosphere.** *Royal Meteorological Society, Quarterly Journal*, 65:537–541, **1939.** 7 refs., 13 eqs. **DLC**—Examination of ERTEL's theory (1933). Considering this, author shows that the assumption of very small but plausible values for the wind direction change with height in the surface layers suffices to account for observed wind velocity increase in the lower layers. It appears that the mean wind direction change with height in the lower layers is too small to be observed practically. *Subject Headings:* **1. Turbulence in the frictional layer 2. Wind profiles 3. Shear stress.**—*H.P.K.*

**4B–109** 551.551

Hoffrogge, Chr., **Experimentelle Untersuchungen der bodennahen Luftströmungen am Hang und in ebenen Gelände.** [Experimental investigations of air currents near the earth on a slope and on level ground.] *Zeitschrift für Geophysik*, Braunschweig, 15(3–4):184–312, **1939.** 11 figs., 44 refs. **DLC**—The critical Richardson number for air currents near the ground is determined as about $\frac{1}{2}$. The same value applies to thermal and dynamical austausch in stable stratification near the ground. Part II describes research into macroclimatic cold air incursions. *Subject Heading:* **1. Atmospheric turbulence.**—*C.E.P.B.*

## 1940

**4B–110** 551.511

Lettau, Heinz, **Ueber die Zeit- und Höhenabhängigkeit des Austauschkoeffizienten im Tagesgang innerhalb der Bodenschicht.** [Dependence of the austausch coefficient on time and height and its diurnal variations in the atmospheric layer near the ground.] *Beiträge zur Geophysik*, 57(2):171–192, **1940.** **DWB**—General solution of the austausch differential equation considering

dependence on time ($t$) and height ($z$) of the austausch coefficient ($A$), still unknown. Author derives the daily variation of ($A$) on the basis of observations made by JOHNSON and HEYWOOD introducing a method for the simultaneous calculation of $A$ and $\partial A/\partial z$. $A$ for $z=45$ m for selected clear summer days 3 at sunrise and 173 at noon [g $cm^{-1}sec^{-1}$]. Diurnal course can be expressed by a combination of harmonic terms with an exponential part. Linear height dependence of $A$ verified. *Subject Headings:* **1. Austausch coefficient 2. Vertical exchange variations 3. Diurnal exchange variations.**—*A.A.*

**4B–111** 551.551

Sherlock, R. H. and Stalker, E. A., **The control of gases in the wake of smoke stacks.** *Mechanical Engineering*, New York, June **1940. DLC**—Describes experiments at Chicago on the downwash in lee of a smoke stack on a building. It occurs in two stages, downflow induced by eddies in the wake of the stack, and dispersion within the turbulent mass of air above and behind the buildings. Cure for downwash is to raise stack to more than one diameter above the upper limit of turbulence due to buildings and increase velocity of stack gases. (*See also item* 4B–114 below.) *Subject Headings:* **1. Turbulent diffusion 2. Smoke dispersion 3. Industrial meteorology.**—*C.E.P.B.*

## 1941

**4B–112** 551.551 551.511

Arakawa, Hidetoshi, **Stabilitätskriterien der atmosphärischen horizontalen Turbulenz.** [Stability criteria for horizontal atmospheric turbulence.] *Beiträge zur Geophysik*, 58(1–2):3–10, **1941.** table, 13 eqs. **DLC**—The equations of motion are extended to cover the case of a stationary high pressure area with stable or unstable lapse rate, and to allow for vertical eddy component, by using the perturbation equations in Eulerian form. PRANDTL's and RICHARDSON's theories of turbulent flow in stratified air layers are also considered and examples of application to turbulent stable motion and laminar stable motion worked out to try and find the boundary conditions which separate the two kinds of motion. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulence theory.**—*M.R.*

**4B–113** 551.524.4

Cowling, T. G. and White, A., **The eddy diffusivity and the temperature of the lower layers of the atmosphere.** *Royal Meteorological Society, Quarterly Journal*, 67(291):276–283, July **1941.** 4 tables, eqs. **DWB**—Four methods of calculating eddy diffusivity from potential temperature range and phase lag are discussed. It is shown that the assumption that $K$ is independent of height even through a shallow layer, and the neglect of the large diurnal variation of $K$ lead to error. Temperature variation is not due only to convection, and may be partly due to radiation. *Subject Headings:* **1. Turbulence in the frictional layer 2. Eddy diffusivity.**—*C.E.P.B.*

**4B–114** 551.551 551.510.42

Sherlock, R. H. and Stalker, E. A., **A study of flow phenomena in the wake of smokestacks.** *Michigan. Univ. Dept. of Engineering Research, Engineering Research Bulletin*, No. 29, March **1941.** 49 p. 34 figs., photo, refs., eqs. **DLC**—Wind tunnel studies of downwash of stack gases show the phenomenon to be connected with eddies in the wake of the stack and turbulent diffusion above and behind the buildings. Determining meteorological factor was found to be wind velocity. Critical stack heights for various wind velocities and directions were determined. (*Same item as* A–134, Jan. 1950, *MAB.*) *Subject Headings:* **1. Industrial meteorology 2. Turbulent diffusion 3. Smoke dispersion 4. Wind tunnel experiments.**—*M.P.K.*

## 1942

**4B–115** 551.551(02)

Bagnold, Ralph Alger, **Physics of blown sands and desert dunes.** New York, William Morrow, [**1942?**] 265 p. 84 figs., 16 plates, eqs. **DLC**—A thorough and systematic treatment in textbook form of many aspects of the problem of sand or dust movement by winds as a problem in turbulent diffusion. The approach is from the engineering standpoint, with much laboratory data, diagrams, etc. to support the theoretical treatment, and vice versa. In chapter 4, on "Surface wind," the ideas of surface drag, laminar and turbulent flow, Reynolds number, wind profile, surface roughness and its effect on turbulence and wind speed, and the boundary layer, are developed. The drag produced by the sand itself is considered in chapter 5. *Subject Headings:* **1. Turbulent diffusion 2. Sandstorms 3. Textbooks.**—*M.R.*

**4B–116** 551.551:551.524.4

Čadež, Marjan, **Vpliv turbulence na nastanek in razvoj inverziter na razvoj ničstopinjskih izotermij.** [Influence of turbulence on the origin and development of inversions and the zero isotherm.] *Slovenska Akademija Znanosti in Umetnosti v Ljubljani, Razprave*, 21(2):481–501, **1942.** 3 figs., 29 refs., 19 eqs. Italian summary p. 496–500. **DWB**—The earlier theoretical work of

MARGULES, WEGENER, KOSCHMIEDER, LETTAU, FINDEISEN, the author and others is reviewed in a systematic manner and applied to the mutual effect of turbulence in lapse rates, cloud formation surface inversions and, finally, the formation of the zero isotherm. The influence of snow falling through turbulent air prevents the formation of a well-defined zero isotherm such as would be found in stable air. (*Same item as* 2.5–108, May 1951, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Inversions 3. Zero isotherm.**—*M.R.*

**4B–117** 551.55

Obukhov, A. M., **On atmospheric turbulence.** *Journal of Physics*, Moscow, 6(5):228–229 **1942.** 2 equations. **DLC**—A brief note containing a formula for determining the spectral distribution of the energy of a turbulent motion. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulence spectrum.**—*M.P.K.*

**4B–118** 551.511 551.551(02

Raethjen, Paul Ernst Günther Siegmund, **Einführung in die Physik der Atmosphäre. Band I Statik und Thermodynamik. Band II, Meteorologische Aerodynamik.** [Introduction to the physics of the atmosphere. Vol. I, Statics and thermodynamics. Vol. II, Meteorological aerodynamics.] Leipzig, B. G. Teubner, **1942–.** 2 v. diagrs., tables, refs. *Hamburger Mathematische Einzelschriften*, v. 31, 33, **1942. DWB**—A practical, technical series of texts on dynamic meteorology with special emphasis on thermodynamic aspects, cloud physics, hydro- and aerodynamic processes in the general and local circulation, vertical motions, turbulence (v. 2, Chap. 7, "Vertical austausch and turbulence"), etc. The theory for each phase is clearly developed but not at great length as in some texts. Vol. III on the heat economy of the atmosphere is not available. *Subject Headings* **1. Turbulent exchange 2. Dynamic meteorology 3. Physics of the atmosphere 4. Textbooks.**—*M.R.*

**4B–119** 551.55

Thornthwaite, Charles Warren and Halstead, Maurice, **Note on the variation of wind with height in the layer near the ground.** *American Geophysical Union, Transactions*, v. 23, Pt. 2:249–255 **1942.** 6 figs., 2 tables, 15 refs., 8 eqs. **DLC**—Samples of low level wind velocity observations made by the Soil Conservations Service in various localities are presented and some of the problems that they raise outlined. Results indicate that a "law which describes the change of wind-velocity with height is a combination of logarithmic and power-laws." *Subject Headings:* **1. Wind profile 2. Atmospheric turbulence.**—*M.P.K.*

**4B–120** 551.57

Thornthwaite, Charles Warren and Holzmann, Benjamin, **Measurement of evaporation from land and water surfaces.** *U. S. Dept. of Agriculture, Technical Bulletin*, No. 817, **1942.** 143 p. 22 figs., 12 tables, 181 refs., 70 eqs. **DLC**—Method for determining water losses to the atmosphere from land surfaces and from free water surfaces sought. Nature and previous methods of determining evaporation reviewed. Importance of turbulence stressed in determination of rate of moisture transfer from a natural surface into the atmosphere. Equation developed for determining this rate. Importance of wind velocity and humidity measurements emphasized, particularly in respect to this equation. Nearly complete hourly record of evaporation and condensation from a field at Arlington Experimental Farm, 1938–1939, kept, and values recorded. (*Same item as* K–11 Nov. 1950, *MAB.*) *Subject Headings:* **1. Evaporation 2. Turbulent transfer of moisture.**—*H.P.K.*

## 1943

**4B–121** 551.55

Albrecht, Fritz, **Turbulenzuntersuchungen.** [Turbulence investigations.] *Meteorologische Zeitschrift*, 60(4):109–121, **1943.** 11 figs., table, 23 refs., 14 eqs. **DWB**—Data obtained on the Gobi Desert and in Potsdam are used in support of theoretical development of equations for relations between the fine structure of the wind and of temperature in the lower layers of the air. The heat exchange between the ground and the air is formulated and graphs show agreement between values obtained and those of Sverdrup. Roughness parameters for various wind directions or lapse rates are also shown graphically. PRANDTL's mixing length and the "Schubspannungsgeschwindigkeit" (shearing stress velocity) formula are discussed. *Subject Headings:* **1. Turbulent transfer of heat 2. Wind structure 3. Gobi Desert 4. Potsdam.**—*M.R.*

**4B–122** 551.551 551.55

†Carruthers, Nellie, **Variations in wind velocity near the ground.** *Royal Meteorological Society, Quarterly Journal*, 69(302):289–301, Oct. **1943.** 4 figs., 7 tables, 28 refs. **DWB**—A valuable summary of the literature of variations of mean and gust velocity, surface to 150 m. The causes are discussed. A power law $v = KH\alpha$ is fitted to the various observations, $\alpha$ varying from .0 to .62 with

mean of about .17. Various definitions of gustiness are discussed and an expression found for variation of maximum gust velocity with height. *Subject Headings:* **1. Turbulence in the frictional layer 2. Micro turbulence 3. Gustiness.**—*C.E.P.B.*

**4B–123** 551.551

Fergusson, S. P., **Gustiness under various weather conditions.** *American Meteorological Society, Bulletin*, 24(1):22–29, Jan. **1943.** 7 figs., refs. Synopsis, p. 22. **MH-BH**—Range of velocity and frequency of gusts were found to be higher on days with strong convection than during other periods when the sky is overcast and the vertical component of the wind is small. *Subject Headings:* **1. Atmospheric turbulence 2. Gustiness.**—*M.P.K.*

**4B–124** 551.573:551.511

Holzman, Benjamin, **The influence of stability on evaporation.** (In: C.-G. Rossby, **Boundary-layer problems in the atmosphere and ocean.** New York, **1943.** p. 13–18. 13 refs., 17 eqs.) **DWB**—Relations between turbulence and stability of the atmosphere discussed. A formula for evaporation when conditions of stability prevail can be derived in a manner similar to that under adiabatic conditions. Concluded that the influence of stability in suppressing evaporation cannot be of great importance. (*Same item as* K–118, Nov. 1950, *MAB.*) *Subject Headings:* **1. Evaporation 2. Atmospheric turbulence 3. Instability.**—*H.P.K.*

**4B–125** 551.551

Kalinske, A. A., **Turbulence and the transport of sand and silt by wind.** *New York Academy of Sciences, Annals*, 44, Art. 1:41–54, May 29, **1943.** 6 figs., 8 refs., 25 eqs. **DWB**—The role of turbulent diffusion in the wind transport of sand and silt by "saltation" is considered. *Subject Headings:* **1. Turbulent diffusion 2. Sand transport.**—*M.P.K.*

**4B–126** 551.596.1:551.551

Soloveĭchik, R. E., **O vliianii viazkosti atmosfery na rasprostranenie zvuka.** [The influence of the viscosity of the atmosphere on the propagation of sound.] *Akademiia Nauk, SSSR, Izvestiia, Ser. Geogr. i Geofiz.*, 7(6):339–343, **1943.** fig., 2 tables, 3 refs. **DLC**—An investigation of the problem of the influence of turbulent viscosity of the propagation of sound in the earth's atmosphere is made. Investigation shows that, taking this factor into account, use should be made of a variable coefficient of turbulent viscosity depending on the length of the sound wave. Satisfactory coincidence with experiment achieved, when the "law of 4/3," found empirically by RICHARDSON and grounded on the theoretical work of A. M. OBUKHOV, is assumed for the coefficient of turbulent viscosity. (*Same item as* J–85, Oct. 1950, *MAB.*) *Subject Headings:* **1. Acoustical propagation 2. Atmospheric turbulence.**—*M.R.*

**4B–127** 551.551

*Thornthwaite, Charles Warren and Kaser, Paul, **Wind-gradient observations.** *American Geophysical Union, Transactions*, Pt. 1, 24:166–182, **1943.** 8 figs., table, 4 refs. **DWB**—From wind gradient records made for more than a year at New Philadelphia, Ohio, with low velocity measuring anemometers, the hourly observations of velocity at various levels up to 28 ft and direction at 28 ft for 31 selected days are tabulated. Some data are presented graphically to show that the "logarithmic law of wind structure is valid only during the morning and evening when the thermal structure of the lower atmosphere is adiabatic." *Subject Headings:* **1. Wind structure 2. New Philadelphia, Ohio.**—*M.P.K.*

## 1944

**4B–128** 551.551:551.509

Beers, Norman R., **Temperature and turbulence in the lower atmosphere.** *Journal of Meteorology*, 1(3–4):78–88, Dec. **1944.** 4 figs., table, 7 refs., 48 eqs. **MH-BH**—Physical considerations imply that eddy diffusivity is a discontinuous function of elevation through the atmosphere. The fundamental assumption is made that eddy diffusivity is a discontinuous step-function of elevation, and the equation of turbulent transfer is solved for the general case where the surface temperature is known as a function of time. The theory shows good agreement when tested with observations. Emphasis is placed throughout on the observed fact that eddy diffusivity is not constant and is a function of weather elements that are regularly forecast. Finally, it is shown how the results of the theory are of importance in forecasting the weather. *Subject Headings:* **1. Turbulent transfer of heat 2. Eddy diffusivity.**—*From author's abstract.*

**4B–129** 551.596.1:551.551

Bronsteĭn, I. M., **K voprosu o zatukhanii zvuka v atmosfere.** [The problem of the extinction of sound in the atmosphere.] *Akademiia Nauk, SSSR, Izvestiia, Ser. Geogr. i Geofiz.*, 8(4):151–153,

**1944.** 5 refs., 8 eqs. **DLC**—Author gives a quantitative determination for the coefficient of ex tinction of sound in the atmosphere, and shows connection between the coefficient of extinction o sound and turbulence of the atmosphere. (*Same item as* J–86, Oct. 1950, *MAB.*) *Subject Heading* **1. Sound absorption 2. Atmospheric turbulence.**—*M.R.*

**4B–130** 551.55

Prandtl, Ludwig, **Zur Frage des vertikalen Turbulenz-Wärmestroms.** [The problem o vertical turbulent heat current.] *Meteorologische Zeitschrift*, 61(1):12–14, Jan. **1944. DWI** Also: **Nochmals der vertikale Turbulenzwärmestrom.** [More on the vertical turbulent heat cu rent.] *Ibid.*, 61(5):169–170, May **1944.** 2 refs., 2 eqs. **DWB**—A rejoinder to ERTEL's (194 criticism of W. SCHMIDT's theory of turbulent exchange of heat (downward) during stable condition in the atmosphere. The author claims that ERTEL's theory holds good only when winds are ver light and insolation at the ground strong. SCHMIDT's theory still holds for strong winds and stab air masses. *Subject Headings:* **1. Turbulent transfer of heat 2. Schmidt's paradox. I. Schmidt, W** —*M.R.*

**4B–131** 551.551:551.51

Raethjen, Paul Ernst G. S., **Zum Wärmestrom der Turbulenz.** [On the heat flux of turbulence. *Annalen der Hydrographie und Maritimen Meteorologie*, 72(5):129–132, **1944.** 9 refs. **DLC**—Th heat flux caused by turbulence is directed from higher layers downwards as long as the temperatu lapse rate is less then the adiabatic. The upwards directed "thermic exchange" begins only whe the adiabatic lapse rate is reached. The vertical heat transfer occurs mainly in latent form of wat vapor transfer. Objects ERTEL's criticism of the austausch theory of SCHMIDT. *Subject Heading* **1. Turbulent transfer of heat 2. Schmidt's paradox. I. Ertel, H.**—*A.A.*

## 1945

**4B–132** 551.551.5:551.511:536

Karush, William (*Atomic Energy Com. Metallurgical Lab., Chicago U.*), **Some problems eddy diffusion.** *U. S. Atomic Energy Commission, AECD-3244*, Aug. 15, **1945.** 21 p. 5 figs 2 graphs, 20 eqs. **DWB**—Author considers theory of diffusion of heat by eddy motion in a tu bulent stream. Heat transfer coefficient is calculated for sidewise diffusion from center of chann and for diffusion parallel to walls. Application to Rib effect is for velocity distribution in an e closed rectangular duct. *Subject Headings:* **1. Turbulent diffusion 2. Turbulent transfer of he 3. Wind tunnel experiments.**—*M.R.*

**4B–133** 551.551:551.596

Krasil'nikov, V. A., **O rasprostranenii zvuka v turbulentnoĭ atmosfere.** [On the propagatio of sound in a turbulent atmosphere.] *Akademiia Nauk, SSSR, Doklady*, 47(7):486–489, **194** 5 refs., 4 eqs. **DLC**—An attempt to explain on the basis of statistical theory of turbulence, exper mental results on fluctuations of the phase of sound waves in a turbulent atmosphere. Formul based on KRASIL'NIKOV (1945), KOLMOGOROV (1941), OBUKHOV (1941) and empirical data GÖDECKE (1935) and FINDEISEN (1936), show dependence on speed of wind and on the 2/3 law KOLMOGOROV. *Subject Headings:* **1. Atmospheric turbulence 2. Acoustical propagation.**—*M.R.*

## 1946

**4B–134** 551.5

Diubiuk, A. F., **Konvektivnye dvizheniia v atmosfere.** [Convective motion in the atmosphere *Meteorologiia i Gidrologiia*, 6:15–25, **1946. DLC**—The author shows three solutions of this proble The first: "Solution without considering the force of friction" he develops through 20 equation The second: "Solution with consideration of frictional force proportional to the vertical velocity takes 22 equations, while the third: "Solution with consideration of the force of internal friction" developed by means of 33 equations. *Subject Heading:* **1. Convection theory.**—*M.R.*

**4B–135** 551.511:551.5

Frost, R., **Turbulence and diffusion in the lower atmosphere.** *Royal Society of London, Pr ceedings, Ser. A*, 186:20–35, **1946.** figs., 2 tables, numerous eqs. **DWB**—A semi-empirical e pression is obtained for $K$ in terms of vertical variation of wind with height according to a pow law (index 1/7). The mixing length of an eddy is assumed to increase with height and to vary wi nature of surface. This expression is then applied to calculation of evaporation from a water surfa and to the distribution of matter from a line source at right angles to an air stream with speci reference to water vapor in air passing from sea to land. Calculations are compared with observ tions. *Subject Headings:* **1. Turbulence in the frictional layer 2. Turbulent diffusion.**—*C.E.P.B.*

**4B–136** 551.551

Liapin, E. S., **Izuchenie koefitsienta peremeshivaniia vozdukha pri pomoshchi opytnykh dymo-puskov.** [A study of coefficient of mixing of air by means of experimental smoke ejection.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. 1, Meteorologiia*, No. 34, Fizika Prizemnogo Sloiia Atmosfery, p. 69–76, **1946.** 4 figs., eqs. **DLC**—Theoretical and experimental results of turbulent mixing under varying meteorological conditions and underlying surface conditions as determined from concentration of smoke found at varying elevations and distances from the source. (*Same item as* 46–8, Oct. 1948, *American Meteorological Society, Bulletin.*) *Subject Headings:* **1. Exchange coefficient 2. Turbulence measurement. 3. Smoke dispersion.**—*M.R.*

**4B–137** 551.551:551.524.4

Liapin, E. S., **Zavisimost' koefitsienta peremeshivaniia ot vertikal'nogo raspredeleniia temperatury vozdukha.** [Dependence of the coefficient of mixing on the vertical distribution of air temperature.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. 1, Meteorologiia*, No. 34, Fizika Prizemnogo Sloia Atmosfery, p. 3–17, **1946.** fig., 13 eqs. **DLC**—I. Influence of turbulent mixing on the temperature of the air. 2. On the translation of energy in the atmosphere and resulting mixing. 3. Total kinetic energy transformed into internal and potential energy as a result of mixing. 4. On the kinetic energy of moving air. 5. Second correlation between coefficient of mixing and mixing parameter. 6. Formula for coefficient of mixing. 7. Coefficient of mixing with various temperature gradients in the atmosphere. (*Same item as* 46–9, Oct. 1948, *American Meteorological Society, Bulletin.*) *Subject Headings:* **1. Exchange coefficient 2. Atmospheric turbulence.**—*M.R.*

**4B–138** 551.510.42:551.551

*Meetham, A. R., **Turbulence and atmospheric pollution.** *Weather*, 1(7):200–205, **1946.** 5 figs., 2 plates. **DWB**—Behavior of smoke worked out from three different types of sources. A series of elaborate diagrams and photographs explains and illustrates smoke concentration and distribution under varying conditions of source and different degrees of turbulence. Quantitative data are given for distance and height. (*Same item as* A–159, Jan. 1950, *MAB.*) *Subject Headings:* **1. Atmospheric pollution 2. Turbulent diffusion.**—*C.E.P.B.*

**4B–139** 551.551

Nägeli, Werner, **Weitere Untersuchungen über die Windverhältnisse im Bereich von Windschutzstreifen.** [Further investigation of wind conditions in vicinity of wind breaks.] *Schweizerische Anstalt für das förstliche Versuchswesen, Zürich, Mitteilungen*, 24(2):659–737, **1946.** 25 figs., 6 tables, refs. Microfilm. **DWB**—A continuation of work done in 1942–43. Chief objects of the new investigations were to determine effects on wind of narrow pine hedges 3–17 m wide and 7–17 m high, of deciduous hedges 12–15 m wide and 3–18 m high, and of combination wind breaks and orchards. Effects of a 1 m high snow fence, of a double row of deciduous trees and of 12 other wind obstructing objects were investigated. In the course of the observations, it was found that the usual height of measurement, 1.4 m, is above the zone of strongest wind variations. *Subject Headings:* **1. Micro turbulence 2. Wind structure 3. Germany.**—*M.P.K.*

**4B–140** 551.551

Obukhov, A. M., **Turbulentnost' v temperaturno neodnorodnoĭ atmosfere.** [Turbulence in an atmosphere with inhomogeneous temperature.] *Akademiia Nauk, SSSR, Institut Teoreticheskoĭ Geofiziki, Trudy*, 1:95–115, **1946.** 3 figs., 3 tables, 6 refs., 38 eqs. Also: *Akademiia Nauk, SSSR, Izvestiia, Ser. Geogr. i Geofiz.*, 13(1):58–69, **1949.** **DLC**—Influence of vertical temperature inhomogeneity on evolution of turbulence in the atmosphere. This influence is quantitatively calculated by applying correction factors to Prandtl's semi-empirical theory; the universal Richardson's criteria being used. As a result it is possible to quantitatively evaluate the height of the dynamic turbulent layer under various conditions. (*Same item as* 1–98, Jan. 1950, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Atmospheric turbulence.**—*M.R.*

**4B–141** 551.554:551.501(47)

*Sapozhnikova, Serafima Afanas'evna, **Izmenenie skorosti vetra s vysotoĭ v nizhnem sloe vozdukha.** [Variation of wind velocity with height in the air layer near the ground.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. 1, Meteorologiia*, No. 33, **1946.** 103 p. figs., tables, refs., eqs. **DLC**—A theoretical and experimental analysis of the vertical stratification of wind velocity in the lower 50 m of the atmosphere. This study begins with a review of the fundamental laws of the variation of wind velocity with height in the lower level of the atmosphere and of the various methods used for measuring wind and temperature in the lower atmospheric layers in 1943–44. The remaining chapters are as follows:

the laws of the variations of wind velocity with height in the lower atmospheric layers over open level places; the laws of the spatial variations of the factors determining the vertical wind profile; and the wind velocity in the lower atmospheric layer in the European U.S.S.R. Data are presented tabularly and graphically. *Subject Headings:* **1. Wind profiles 2. Wind observation 3. U.S.S.R.** —*I.L.D.*

**4B–142** 551.551

Zubenok, L. I., **Nekotorye dannye o turbulentnom potoke tepla mezhdu zemleĭ i atmosferoĭ.** [Some data on the turbulent flow of heat between earth and atmosphere.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchreshdeniĭ, Ser. 1, Meteorologiia*, No. 34, Fizika Prizemnogo Sloia Atmosfery, p. 77–82, **1946.** 3 figs., 2 refs., 4 eqs. **DLC**—The conclusions of this work are made on the basis of theoretical investigations carried out by BUDYKO and published in *Akademiia Nauk SSSR, Ser. Geogr. i Geof., Izvestiia*, No. 4, 1946, the observations made by SAPOZHNIKOVA at Saratov during the summer of 1943 and author's observations at Leningrad during 1945. It has been found that the value of turbulent heat exchange with inversion conditions is insignificant in comparison to the value of heat flow with superadiabatic gradients. *Subject Headings:* **1. Turbulent transfer of heat 2. Atmospheric turbulence 3. U.S.S.R.** —*N.T.Z.*

## 1947

**4B–143** 551.551:551.554

*Berliand, M. E., **Teoriia izmeneniia vetra s vysotoĭ.** [Theory of wind variation with height.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. 1, Meteorologiia*, No. 25, Fizika Prizemnogo Sloia Atmosfery, p. 14–67, **1947.** 18 figs., 8 tables, 32 refs. **DLC**—The problem of constructing the wind profile up to 1000 m, based on observations at two levels near the ground, is studied. Theoretical basis is discussed at length, and a valuable comparison with observational results is given (relationships between gradient wind and wind velocity at 1 m height, between wind deviation angle and temperature gradient 20 cm–150 cm, between height of friction layer and wind velocity, wind profile, etc.) *Subject Headings:* **1. Friction layer 2. Boundary layer 3. Wind profiles.**—*A.A.*

**4B–144** 551.573 551.551

Budyko, M. I., **Vliianie meteorologicheskikh faktorov na isparenie uvlazhnennoĭ pochvy.** [The influence of meteorological factors on evaporation from moist soil.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. 1, Meteorologiia*, No. 25, Fizika Prizemnogo Sloia Atmosfery, p. 3–13, **1947.** 7 figs., eqs. **DLC**—The investigations carried out by the author show that the well-known law of DALTON has sufficient accuracy for the computation of the evaporation from an open surface. The dependence of the evaporation rate from the intensity of the turbulence exchange, wind velocity, soil temperature, and humidity of the air is determined. The author presents the following formula for the computation of evaporation from the moist soil. $E = A(P_s - P_o)U^{0.75}(Ri_k - Ri_l)^{0.25}$ where $A$ is coefficient depending on the thickness of rough layer, $P_s$ and $P_o$-absolute humidity of the air near the ground and near the evaporating surface; $Ri_k$ and $R_{il}$ are Richardson's numbers determined by potential temperature of the air, absolute humidity, wind velocity and the acceleration of gravity. *Subject Headings:* **1. Evaporation from soil 2. Micro meteorological turbulence.**—*N.T.Z.*

**4B–145** 551.551

Davies, D. R., **Turbulence and diffusion in the lower atmosphere with particular reference to the lateral effect.** *Royal Society of London, Proceedings, Ser. A*, 190(1021):232–244, July 8, **1947.** 3 tables, 5 refs., 7 eqs. **DWB**—SUTTON's (1932, 1934) theory of atmospheric turbulence gives good results for rate of evaporation from plane, saturated liquid surfaces, according to PASQUILL (1943), but overestimates concentration of vapor at any point and underestimates the rate of diminution of vapor above finite surfaces. This paper which develops the equations of diffusion and boundary conditions, the wind speed and diffusivity (1) constant or (2) variable with height or (3) with lateral diffusivity zero and (4) with appreciable lateral diffusion, shows that introduction of the lateral diffusion factor provides an improvement over the older theory. Solutions for other shapes than the parabolic one used here should be worked out experimentally and theoretically. *Subject Headings:* **1. Turbulent diffusion 2. Evaporation theory 3. Lateral exchange 4. Wind tunnel experiments.**—*M.R.*

**4B–146** 551.511

Diubiuk, A. F., **K vychisleniiu vertikal'nykh skorosteĭ po poliu davleniia.** [The calculation of vertical velocity from the field of pressure.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. II, Sinoptichesko.a Meteorologiia,*

Vo. 24:28–51, **1947.** table, 155 eqs. **DWB**—A mathematical treatise using the methods of I. A. Cibel', on the calculation of vertical velocities from the force of surface friction and of turbulent r interior friction. Cases of divergence, stationary cases. *Subject Headings:* **1. Dynamics of the tmosphere 2. Frictional effects.**—*M.R.*

**4B–147** 551.551

Frenkiel, François, N., **Mesure de la diffusion turbulente du vent naturel dans le voisinage du ol.** [Measurement of the turbulent diffusion of the natural wind in the vicinity of the earth's rface.] *Académie des Sciences, Paris, Comptes Rendus,* 224(2):98–100, Jan. 13, **1947.** 5 refs., eqs. **DWB.** Review by Stefan Bergman in: *Applied Mechanics Reviews,* 1(10):270, Oct. **1948.** )WB—The author made 3 experiments in Jan. 1940 at Lille, using ammonia and recording the ercentage (of that emitted) that would be caught at a distance of 72 or 73 cm and a height of 100 r 200 cm, to determine the amount of turbulent diffusion in the atmosphere near the ground. esults are briefly tabulated and discussed. *Subject Headings:* **1. Micro meteorological turbulence . Turbulent diffusion of gases. I. Bergman, Stefan.**—*M.R.*

**4B–148** 551.551

IUdin, M. I., **Prikladnye problemy ucheniia ob atmosfernoĭ turbulentnosti.** [Applied problems f atmospheric turbulence.] *Meteorologiia i Gidrologiia,* 3:3–10, **1947.** 29 refs. **DWB**—The uthor shows the close connection between turbulence and various aspects of human activity by numerating over thirty practical problems depending upon the laws of turbulent motion. The hysical bases of the great majority of applications of the theory of atmospheric turbulence can be assified as follows: Turbulent vertical transfer of heat, moisture, and mass near the underlying rface; the theory of turbulent diffusion of mixtures in the atmosphere, and analysis of the structure f the fields of wind, temperature, and pressure. Each of these groups is analyzed, with emphasis n its practical significance. *Subject Headings:* **1. Turbulent exchange 2. Turbulent diffusion . Wind structure.**—*C.K.*

**4B–149** 551.551

Koo, Chen-chao, **The general laws of frequency distribution of wind in a gust.** *Meteorological Magazine,* Nanking, 19(1–4):58–62, Aug. **1947.** 8 refs., eqs. In Chinese, English summary p. 58. **IH-BH**—The function for distribution of wind velocities in gusts is calculated when the two horiontal components of turbulence are correlated. The correlation is found to decrease as the steady ind velocity increases. (*Same item as* 2.4–109, April 1951, *MAB.*) *Subject Headings:* **1. Turulence statistics 2. Gustiness.**—*C.E.P.B.*

**4B–150** 551.551 551.509

Kovalenko, N., **Prilozhenie kriteriia Richardsona k nekotorym voprosam prognoza pogody.** Application of Richardson's criterion to some problems of weather forecasting.] *Meteorologiia i idrologiia,* 3:59–63, **1947.** 3 figs., 2 tables, 6 eqs. **DWB**—An attempt to utilize Richardson's riterion for determination of eventual increase or decrease of atmospheric turbulence for forecasts f thunderstorms, showers and cloudiness. Graphs and tables are included in illustration of such use i micrometeorological forecasting. *Subject Headings:* **1. Atmospheric turbulence 2. Richardson riterion.**—*C.K.*

**4B–151** 551.554

Laĭkhtman, D. L., **O profile vetra v prizemnom sloe atmosfery pri statsionarnykh uslviiakh.** Wind profile in the air layer near the ground under stationary conditions.] *U.S.S.R. Glavnoe pravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. 1, leteorologiia,* No. 39, Fizika Prizemnogo Sloia Atmosfery, p. 58–76, **1947.** 10 figs., eqs. **DLC**—Vith stable or unstable conditions, the vertical variation of the wind velocity differs essentially from he logarithmic law. The author derives a formula for the increase of wind velocity with height or any state of the atmosphere and verifies it experimentally. Some conclusions of Prandtl pertaining to this problem are generalized. *Subject Heading:* **1. Wind profiles.**—*N.T.Z.*

**4B–152** 551.551 551.506.5

Laĭkhtman, D. L. and Sapozhnikova, S. A., **Arysskaia ekspeditsiia 1945 goda.** [Arys expedition 1945.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. 1, Meteorologiia,* No. 39, Fizika Prizemnogo Sloia Atmosfery, p. 3–10, 947. 5 figs., eqs. **DLC**—This expedition was organized by the Central Geophysical Observatory r investigation of wind variations near the ground and laws of heat exchange between surface and tmosphere. The town Arys' is located 125 km NNW from Tashkent in a desert zone. In addition the usual observations of wind velocity and temperature near the ground, the observations of the olar radiation and basic pilot balloon observations were carried out. *Subject Headings:* **1. Turbulent ansfer of heat 2. Wind profiles 3. Arys' Expedition 1945 4. Arys', Uzbek S.S.R.**—*N.T.Z.*

**4B–153** 551.51

Lettau, Heinz, **Zur Theorie der partiellen Gasentmischung in der Atmosphäre.** [On the theor of partial diffusion of gas in the atmosphere.] *Meteorologische Rundschau*, 1(1–2):5–10, July–Aug **1947.** 2 tables, 38 eqs., bibliog. **DLC**—Mixing of gases in atmosphere by means of turbulence is s thorough at all elevations thus far measured, that molecular "austausch" cannot be considere When vertical circulation is lacking, the light gases increase with height. (*Same item as* 1–6 Jan. 1950, *MAB.*) *Subject Headings:* **1. Turbulent diffusion of gases 2. Atmospheric turbulence.**— *M.R.*

**4B–154** 551.556:551.46:532.5

Munk, Walter H., **A critical wind speed for air-sea boundary processes.** *Journal of Mari Research*, 6(3):203–218, **1947.** 8 figs., 4 plates, 4 tables, 23 refs., 12 eqs. **DLC**—This article dea with the discontinuities or abrupt changes manifested by various processes at the air-sea boundar when the wind velocity is about 7 m/sec. The turbulence model of Rossby and Montgomery discussed and the application considered of the Kelvin-Helmholtz instability criterion which involve the transition from laminar to turbulent flow and gives instability for wind speeds exceeding 6.5 m sec. (For fuller abstract *see item* 11–113, Nov. 1950, *MAB.*) *Subject Headings:* **1. Boundary laye 2. Ocean-atmosphere interaction 3. Origin of turbulence.**—*I. L. D.*

**4B–155** 551.55

Neis, B., **Ein Wirbelmodell der atmosphärischen Turbulenz.** [A vortex model of atmospheri turbulence.] *Zeitschrift für Meteorologie*, 1(4/5):114–122, Jan.–Feb. **1947. DWB.** Review b Horst Merbt in: *Applied Mechanics Reviews*, 2(1):23, Jan. **1949.** 7 figs., 3 tables, 12 refs., eq **DWB**—Following the precedence of Robitzsch (1919), Rümelin (1913) and Barkow (1915) th author develops a model of atmospheric wind structure. By superposing fields of cylindrical vorte sheets he explains records of gustiness. Additional investigation of energies shows the ratio of th kinetic energy of the turbulent flow, to that of laminar flow of the same average speed, to be 1.3 *Subject Headings:* **1. Atmospheric turbulence 2. Wind structure. I. Merbt, Horst.**—*H. Merbt.*

**4B–156** 551.551 551.58

Sapozhnikova, Serafima Afanas'evna, **Nekotorye osobennosti v raspredelenii temperatur vlazhnosti i vetra v prizemnom sloe vozdukha.** [Some peculiarities in distribution of temperatur humidity and wind in the air layer near the ground.] *U.S.S.R. Glavnoe Upravlenie Gidrometeor logicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. 1, Meteorologiia*, No. 3 Fizika Prizemnogo Sloia Atmosfery, p. 44–57, **1947.** 10 figs., 2 tables, 4 refs. **DLC**—These i vestigations were made by the Arys' expedition of the Central Geophysical Observatory in th summer of 1945 over bare and covered surfaces. For the measurement of wind velocity the Englis "Meteor" anemometers were used at heights from 0.06 to 5.0 m and the usual electric anemomet at a height of 10.8 m. The temperature and humidity observations at heights of 0.05 m; 0.2 m 0.5 m and 1.5 m were made by means of Assman psychrometers. Daily variations of these elemen and their interrelations are analyzed and discussed. *Subject Headings:* **1. Micrometeorologic profiles 2. Arys' Expedition 1945 3. Arys', Uzbek.S.S.R.**—*N. T. Z.*

**4B–157** 551.51

Sapozhnikova, Serafima Afanas'evna, **Teploobmen pochva-vozdukh.** [Soil-air heat exchange. *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skik Uchrezhdeniĭ, Ser. 1, Meteorologiia*, No. 39, Fizika Prizemnogo Sloia Atmosfery, **1947.** p. 77–8 4 figs., 3 refs. **DLC**—The author discusses the problem of the heat balance and its dependence o variations of wind velocity, cloudiness, stability of the atmosphere, etc. The analysis made from series of special observations at Arys' shows that the formula presented before for computation heat exchange and which uses only wind velocity as the variable value does not give accurate result especially during warm seasons. *Subject Heading:* **1. Turbulent transfer of heat 2. Soil-air he exchange.**—*N. T. Z.*

**4B–158** 551.55

Schmitz, Hans Peter, **Eine Erweiterung der bisherigen Theorien des vertikalen Turbulen wärmestroms.** [An extension of present theories concerning the vertical turbulent heat flow *Zeitschrift für Meteorologie*, 1(14):422–430, Nov. **1947.** figs., refs., 111 eqs. **MH-BH.** Revie by Leslie S. G. Kovasznay in: *Applied Mechanics Reviews*, 2(3):72, March **1949. DWB**—"A extensive investigation of the problem of vertical transport of heat and some other scalar quantiti in the atmosphere when no vertical mean motion is present." An expression is derived for expressi transport in the vertical direction in terms of the vertical turbulent velocity component and th fluctuation of density, pressure, temperature and potential temperature. "The method is used discuss in detail the transport of heat, potential temperature, entropy and enthalpy between hor

ontal planes, with or without heat sources or sinks present." *Subject Headings:* **1. Turbulent xchange 2. Turbulent transfer of heat. I. Kovasznay, Leslie S. G.**—*M.P.K.*

**4B–159** 551.554

Sheppard, P. A., **The aerodynamic drag of the earth's surface and the value of von Kármán's onstant in the lower atmosphere.** *Royal Society of London, Proceedings, Ser. A*, 188:208–222, 947. 5 figs., 3 tables, 13 refs., 12 eqs. **DLC**—Simultaneous measurements of drag which the earth's rface exerts on wind and of the velocity profile above the surface have enabled von Kármán's onstant for the lower atmosphere to be deduced, along with evidence of considerable variation in the onstant with atmospheric stability. These observations of drag and velocity profile are also used o determine variation of mixing length with height; values are in relation to stability. *Subject leadings:* **1. Wind profiles 2. Mixing length.**—*H.P.K.*

**4B–160** 551.510.42:551.551

Sutton, O. G., **The problem of diffusion in the lower atmosphere.** *Royal Meteorological Society, Quarterly Journal*, 73(317/318):257–281, July/Oct. **1947.** fig., 3 tables, 9 refs. Discussion. **DWB**— detailed technical account is given of a theory of atmospheric diffusion developed at Porton 932–1938. The theory leads to formulas of the correct functional form for calculating atmospheric iffusion in the absence of very large temperature gradients and when wind gradient is observed bove the layer where surface roughness predominates. Some observations on rate of evaporation iven also. (*Same item as* A–198, Jan. 1950, *MAB.*) *Subject Headings:* **1. Turbulent diffusion . Atmospheric pollution.**—*M.R.*

**4B–161** 551.510.42:551.551

Sutton, O. G., **The theoretical distribution of airborne pollution from factory chimneys.** *Royal Meteorological Society, Quarterly Journal*, 73(317–318):426–436, July–Oct. **1947.** 7 tables, refs. **1H-BH**—Refinement of theories of eddy diffusion (Bosanquet and Pearson, 1936), enables uthor to calculate numerical values for diffusion coefficients, for concentrations of contaminants at round a given distance downwind from a source of a given height, etc. Effects of change in stability n diffusion coefficient and on numerical values discussed. Results in agreement with measurements nade at Trail, B.C., by Hewson. Mathematical theory given in detail. Summary of the paper y author in *Weather*, 2:249–251, 1947. (*Same item as* A–199, Jan. 1950, *MAB.*) *Subject Headings:* **. Turbulent diffusion 2. Atmospheric pollution 3. Smoke dispersion.**—*H.P.K.*

## 1948

**4B–162** 551.554 551.551

Frankenberger, Ernst, **Über den Austauschmechanismus der Bodenschicht und die Abhängigkeit des vertikalen Massenaustausches vom Temperaturgefälle nach Untersuchungen an den 70 m ohen Funkmasten in Quickborn/Holstein.** [On the exchange mechanism of the surface layer and ne dependence of vertical mass exchange upon the temperature gradient, based upon investigations n 70 m high radio masts in Quickborn/Holstein.] *Annalen der Meteorologie, Beiheft*, **1948.** p. –23. 9 figs., table, eqs., 27 refs. English summary p. 23. **DWB**—A paper describing the numerus problems connected with measurement of the behavior of turbulent eddies, containing detailed escriptions of the instruments used in measuring the microstructure of the wind and of the calculaon methods employed. Vertical exchange is shown to be connected with turbulent fluctuations f a convective nature, including those generated near the ground by friction and those related to nort wind fluctuations in which vertical movements of the air greatly surpass the mixing length. mpirical formulas show the dependence of turbulence characteristics on stability, and approximate rmulas are derived for the coefficient of vertical austausch for stable and unstable states at a height f 70 m. *Subject Headings:* **1. Turbulence in the frictional layer 2. Turbulent transfer of mass . Tower observations.**—*M.R.*

**4B–163** 551.551

Hewson, E. Wendell, **Research on turbulence and diffusion of particulate matter in the lower yers of the atmosphere.** Massachusetts Institute of Technology, Contract AF28(099)-7, Progress eports No. 1–6, Nov. 1, **1948** to April 30, **1950,** Feb. **1949** to May **1950. DWB**—An elaborate rogram was set up at the Massachusetts Institute of Technology, Round Hill Field Station, for udying turbulent diffusion of smokes and gases by means of balloons, tower measurements and notion pictures of smoke, and for testing theories of turbulent exchange. Diurnal variation in rbulent mixing, the nature of turbulent diffusion as evidenced by the scatter of balloons when rossing shorelines or when caught in thermal convection currents, the structure of atmospheric ddies in the lower layers (as affected by soil cover, topography, radiation, etc.) and the development f instruments for determining eddy coefficients are among the projects attempted. Special emphasis as placed on developing an eddy flux and gustiness recording apparatus. *Subject Headings:* **. Turbulence research 2. Turbulent diffusion 3. Smoke dispersion 4. Gustiness meters.**—*M.R.*

**4B–164** 551.55

Johannessen, Thor Werner, **On the eddy stress and viscosity in air currents.** *Meteorologisk Annaler*, Oslo, 2(14):465–499, **1948.** 2 figs., 13 tables, refs. In English. **DWB**—The results o an examination of the eddy stress in air masses of different stratification smoothed over long and shor periods. Laboratory investigations of turbulence lead to an equation which is not applicable unde natural conditions because in nature the atmosphere is stratified, the air currents are under th influence of shearing stress, etc. Eddy viscosity and turbulence studied by means of sounds a DeBilt. (*Same item as* 1–97, Jan. 1950, *MAB.*) *Subject Heading:* **1. Atmospheric turbulence.**

**4B–165** 551.511 551.55

†Lettau, Heinz, **Dynamik der Atmosphäre.** [Dynamics of the atmosphere.] (In Mügg Ratje (ed.), **Meteorology and physics of the atmosphere.** *FIAT Review of German Science 1939 1946*, 19:115–173, **1948.** 182 refs. **DWB**—A review of investigations made in Germany during th war. Pages 119–121 and 140–148 deal with turbulence. Especially important are investigations o the transfer mechanism of heat, water vapor and momentum, free turbulence, the influence of tu bulence on the daily course of meteorological elements, convection cells, large scale turbulenc turbulent heat currents and optical disturbances associated with turbulence. Lettau found tha the exchange coefficients for heat and momentum are practically equal in the lowest 100 m. Pape dealing with Schmidt's paradox discussed. *Subject Headings:* **1. Turbulent exchange 2. Atmospher turbulence 3. Schmidt's paradox.**—*A.A.*

**4B–166** 551.51

†Montgomery, R. B., **Vertical eddy flux of heat in the atmosphere.** *Journal of Meteorolog* 5(6):265–274, Dec. **1948.** table, 34 refs., 48 eqs. **MH-BH**—The author defines eddy diffusivit and develops the formula for energy flux from an open system in order to establish more preci terms for the vertical eddy flux of heat: (1) neglecting latent heat, and (2) including latent hea Finally, formulas are developed for the eddy flux of heat from dry ground and from moist groun fresh water or salt water, and from ice. The separation of the heat transfer from the ocean to th atmosphere into (1) conduction and (2) latent heat of evaporation is considered artificial; the tw being combined into one parameter in this work. Most of the fundamental papers in this field ha been considered and listed as references. (*Same item as* 3–47, March 1950, *MAB.*) *Subject Hea ings:* **1. Atmospheric turbulence 2. Turbulent transfer of heat.**—*M.R.*

**4B–167** 551.5

Shiotani, Masao and Yamamoto, Gi-ichi, **Turbulence in the free atmosphere. (1st Report** *Geophysical Magazine*, Tokyo, 20(1):21–30, Nov. **1948.** illus. p. 105. 5 figs., 5 tables, refs., eq **DWB**—Wind velocity fluctuations were recorded at 50, 47, 44, 41 and 38 m above ground at Ma bashi broadcasting station by hot wire anemometers. Following the line of research of Taylo intensity and scale of turbulence and eddy viscosity were calculated from five minute record *Subject Headings:* **1. Turbulence in the frictional layer 2. Turbulence data 3. Tower observatio 4. Maebashi, Japan.**—*M.P.K.*

**4B–168** 551.5

Sutton, O. G., **Convection in the atmosphere near the ground.** *Royal Meteorological Socie Quarterly Journal*, 74:13–30, Jan. **1948.** 3 figs., 3 tables, 14 refs., 31 eqs. **DLC**—Aspects of proble of heat transfer in the lower atmosphere considered, in particular the general nature of flux of he through the lower atmosphere on a clear summer day. Concluded that to explain such heat flo the nature of vertical currents due to buoyancy and their effect on virtual coefficient of conducti must be considered. New theoretical treatment advanced. *Subject Headings:* **1. Turbulent transf of heat 2. Convection.**—*H.P.K.*

**4B–169** 551.594.11:551.5

Tverskoĭ, P. N. and Timofeev, M. P., **Turbulentnost' i vertika'lnyĭ profil' napriazhenno elektricheskogo polia v nizhnem sloe atmosfery.** [Turbulence and the vertical potential gradie in the lower layers of the atmosphere.] *Akademiia Nauk, SSSR, Izvestiia, Ser. Geogr. i Geofi* 12(5):377–386, **1948.** 3 figs., 5 tables, 6 refs., 18 eqs. **DLC**—Assuming that the potential gradie varies linearly with height, it is shown that the conductivity does not change with height. I troducing refinements into Whipple's formula for the case of uniform turbulence (with height), t role of turbulence in the vertical distribution of potential gradient is developed, and future lin of investigation outlined. (*Same item as* 1–163, Jan. 1950, *MAB.*) *Subject Headings:* **1. Atmosphe electricity 2. Turbulence in the frictional layer.**

**4B–170** 551.511

**Zamechaniia o kriterii i chisle Richardsona.** [Remarks on Richardson's criterion and number.] *Meteorologiia i Gidrologiia*, 6:79, June **1948.** eqs. **DLC**—The aim of this note is to correct some rroneous physical notions and conclusions based on Richardson's criterion of variation in time of urbulent energy. *Subject Headings:* **1. Atmospheric turbulence 2. Richardson criterion.**—*M.R.*

## 1949

**4B–171** 551.554:551.584:551.510.42

Aujeszky, László, **A helyi szélklima megállapitásának módszereiről.** [Methodology of micro-neteorological wind investigations.] *Időjárás*, 53(11–12):392–394, Nov.–Dec. **1949.** English ummary p. 408. **MH-BH**—Limited samples of wind conditions in a small area, obtained by use of ortable anemometers, do not give a true picture of the wind field which would affect dispersal of ndustrial atmospheric pollution. The topography, air mass properties and other micrometeoro-ogical peculiarities must be considered. (*Same as item* 2.7–118, July 1951, *MAB.*) *Subject Head-ngs:* **1. Micro turbulence 2. Atmospheric pollution.**—*M.R.*

**4B–172** 551.551:551.508.13:551.571

Bunker, Andrew F., **Transport of water vapor by eddy diffusion in continental air masses flowing ver coastal waters, Sept. 23, 1947–Nov. 16, 1948.** Woods Hole Oceanographic Institution, Contract N6onr-277, Task Order 2, Technical Report No. 2 on Marine Meteorology, March **1949.** 38 p. llus., diagrs., 23 refs. (Ref. No. 49-23.) **DWB**—Measurements of the transport of water vapor n the turbulent layer of the atmosphere have been made from 12 series of airplane soundings. The irplane, equipped with a psychograph which recorded dry- and wet-bulb temperatures, made scents in the air over the mainland and at several positions downwind over the coast waters of outheastern Massachusetts. The measured accumulation of the water vapor in the homogeneous ayer was used to compute the net upward flux of vapor per unit time and area. Values of this trans-ort in the non-steady state are given and are shown to vary with the wind speed. Under the as-umption that the flow is the net result of the turbulent motions of the air, values of the coefficient of nass exchange have been computed from the classical diffusion equation. The magnitude of this oefficient increases with height, decreases with distance from shore and depends on the wind speed and n the stability of the air. *Subject Headings:* **1. Turbulent diffusion 2. Turbulent transfer of heat . Marine meteorology 4. Air mass transformation 5. Southeastern Massachusetts. I. Woods Hole Oceanographic Institution II. Contract N6onr-277, Task Order 2.**—*Contractor's abstract.*

**4B–173** 551.551

†Calder, K. L., **The criterion of turbulence in a fluid of variable density, with particular reference o conditions in the atmosphere.** *Royal Meteorological Society, Quarterly Journal*, 75(323):71–88, an. **1949.** table, 26 refs., 53 eqs. **DWB**—Energy equation of eddy motion in a fluid of variable ensity derived with particular reference to conditions in the atmosphere. General form of the riterion for growth or decay of turbulence then deduced. Richardson criterion of turbulence xamined. *Subject Headings:* **1. Richardson criterion 2. Atmospheric turbulence.**—*H.P.K.*

**4B–174** 551.551:551.573

Calder, K. L., **Eddy diffusion and evaporation in flow over aerodynamically smooth and rough urfaces; a treatment based on laboratory laws of turbulent flow with special reference to conditions n the lower atmosphere.** *Quarterly Journal of Mechanics and Applied Mathematics*, 2:153–176, **949.** 8 tables, 22 refs., 48 eqs. Review by R. L. Pigford in: *Applied Mechanics Reviews*, 3(10):315–16, Oct. **1950.** **DWB**—A theoretical treatment of the problems of eddy diffusion and evaporation s developed, based on the use of well-established laboratory data for the laws of turbulent flow. ormulas developed may also be applied to the transfer of heat from aerodynamically smooth and ough surfaces provided the temperature differences are not too large. (*Same item as* K–166, Nov. 950, *MAB.*) *Subject Headings:* **1. Turbulent diffusion 2. Evaporation. I. Pigford, R. L.**—*M.P.K.*

**4B–175** 551.551:551.524.4:551.571.4:551.558

Craig, Richard A., **Vertical eddy transfer of heat and water vapor in stable air.** *Journal of Meteorology*, 6(2):123–133, April **1949.** 5 figs., 3 tables, 26 refs., 23 eqs. **MH-BH**—Based on about 0 airplane soundings representing simple conditions made in the lowest 100 ft over Massachusetts ay, the effect of eddy diffusion in modifying an air mass travelling from land to sea (30 miles over ater) is analyzed. Numerical values of eddy diffusivity and evaporation are calculated for each ounding and stability type and theoretical models showing the changes in lapse rates developed. onclusion is that height to which air masses are modified in travelling 50 miles over warm water is nly a few hundred feet, increases most rapidly at first, and depends on stability. (*Same item as* .8–123, Aug. 1952, *MAB.*) *Subject Headings:* **1. Turbulent diffusion 2. Heat transfer 3. Water apor transport 4. Air mass modification 5. Airplane soundings 6. Massachusetts Bay.**—*M.R.*

**4B–176** 551.551:632.18

Crosby, John S., **Vertical wind currents and fire behavior.** *U. S. Forest Service, Fire Contro Notes*, 10(2):12–15, April **1949.** **DWB**—A concise summary of the effect of local solar heating an of meteorological conditions, especially turbulent winds or eddies, on forest fire danger behavio The causes of convective or of orographic turbulence are outlined, and several clues that can be use to forecast or expect turbulence are mentioned: 1) cloud formations—cumulus or cumulonimbu indicate vertical currents and turbulence, stratus indicate stability; 2) visibility—unusually goo visibility indicates unstable conditions, poor visibility, stable conditions; 3) cool air masses (followin cold fronts) indicate turbulent conditions will follow; warm air, stability; 4) local wind condition and 5) local heating. *Subject Headings:* **1. Turbulence in the frictional layer 2. Convection 3. Fir danger.**—*M.R.*

**4B–177** 551.524.4:551.551:551.55

Deacon, E. L., **Vertical diffusion in the lowest layers of the atmosphere.** *Royal Meteorologica Society, Quarterly Journal*, 75(323):89–103, **1949.** 6 figs., 3 tables, 14 refs., 11 eqs. **DWB**—Semi empirical treatment of vertical diffusion of matter in lowest layers of the atmosphere given. Treat ment based on results of extensive investigation of vertical profiles of mean velocity in lowest 10 m of the atmosphere. *Subject Headings:* **1. Turbulent diffusion 2. Wind profiles.**—*H.P.K.*

**4B–178** 551.510.42:61

Eisenbud, Merril, Wanta, R. C., Dustan, Cyril, Steadman, L. T., Harris, W. B. and Wolf, R. S **Non-occupational berylliosis.** *Journal of Industrial Hygiene and Toxicology*, New York, 31(5):282 294, Sept. **1949.** 5 figs., 7 tables, 5 refs. **DLC**—In this study of a pulmonary disease involving unique factor effluent, beryllium, the past exposure of the neighboring community is estimated fro recent atmospheric samples. Present and past plant operation and meteorological conditions ar discussed. An estimate of the average concentration $\frac{3}{4}$ mile distant from two sources, one 185 f and the other 33 ft in height, is made using concentration data obtained at other distances, an the diffusion equations of SUTTON, BOSANQUET and PEARSON. Distinction is made in the applica tion of these expressions between downwind samples of short duration and long term samples a fixed stations. (*Same item as* No. 4–39, April 1950, *MAB.*) *Subject Headings:* **1. Atmospheri pollution 2. Medical meteorology 3. Turbulent diffusion.**—*Harry Wexler.*

**4B–179** 551.551:551.511:551.515.3:551.510.4

El-Fandy, M. G., **Dust—an active meteorological factor in the atmosphere of northern Africa** *Journal of Applied Physics*, 20(7):660–666, July **1949.** 6 figs., 4 tables, 12 refs., 13 eqs., appen **DLC**—A theoretical discussion of the role of dust particles in the turbulent transfer of heat an moisture, in the development of convection and in upsetting the radiation balance and thus modifyin the air masses over desert regions. Data obtained in Egypt and North Africa are used to suppo theory. Rate of settling, effect of visibility, transfer of dust up to 3,000 ft or more by ordinar surface winds, etc. taken into consideration. It is stated that the dust carries heat aloft and creat its own convection by giving up heat rapidly to surrounding air, and by absorbing direct and scatter radiation. (*Same item as* No. 7–36, July 1950, *MAB.*) *Subject Headings:* **1. Dust storms 2. Tu bulent transfer of heat 3. Turbulent transfer of moisture 4. Radiation balance 5. North Africa.** *M.R.*

**4B–180** 551.5

Frenkiel, François N., **On turbulent diffusion.** U. S. Naval Ordnance Lab. Research Symposi Proceedings, White Oak, Md., July 1, **1949.** Abstracted from reprint.—This brief paper is interesti from a methodological point of view and could be studied as an introduction to the statistical theory turbulence. Turbulent diffusion is discussed first for a fluid at rest. The method for obtaining th standard deviation ($\sigma$) dependent on the time of diffusion is explained. $\sigma$ is shown to be proportion to time at the beginning of the diffusion process and to the square root of time near the end of th diffusion process. The expression for the Lagrangian correlation curve still seems to be a problemat question. Results obtained are applied to turbulent diffusion in fluid flow. Results of some e perimental measurements are shown. *Subject Headings:* **1. Statistical theory of turbulence 2. Tu bulent diffusion.**—*A.A.*

**4B–181** 551.551:551.576.11 551.574

Gabilly, A., **Sur le rôle que peuvent jouer les rafales dans la coalescence des gouttelettes d'e nuage.** [On the role that gusts play in the coalescence of cloud droplets.] *Annales de Géophysiq* 5(3):232–234, July–Sept. **1949.** 6 refs., eqs. **MH-BH**—A theoretical analysis of the coalescence cloud droplets by the action of gusts which impart varying velocities to droplets of different masse An equation for calculating the number of droplets that coalesce given the number of droplets p cubic centimeter, velocity of the droplets and a coefficient of coalescence is derived. Sever

umerical applications are presented. The efficiency of gusts rises very rapidly as the diameter of he droplets increases. (*Same as item* 2.1–130, Jan. 1951, *MAB.*) *Subject Headings:* **1. Gustiness . Cloud physics.**—*I. L. D.*

**4B–182** 551.551:551.584

*†Huss, P. O. and Portman, D. J., **Study of natural wind and computation of the austausch urbulent constant.** *Akron, Ohio. Univ. Daniel Guggenheim Airship Institute, Technical Report,* Jo. 2, Feb. **1949.** 50+p. 36 figs., tables, 19 refs. (*DGAI Report* No. 156.) **DWB**—Results of bservations made at several levels on a 350 ft tower near Akron, Ohio. An intensive program of nicrometeorological observations, including pyrheliometer, wind, temperature, humidity, etc., for etermining austausch coefficient was carried out and methods, theory, instrumentation and results, ogether with recommendations for future investigations is given in tables and graphically. Varia- ions of wind with height difficult to determine accurately. Variations in Richardson number as ell as austausch determined. (*Same item as* 1–96, Jan. 1950, *MAB.*) *Subject Headings:* **1. Tur- ulent exchange 2. Micrometeorological data 3. Richardson criterion 4. Tower observations. I. )aniel Guggenheim Airship Institute.**—*M. R.*

**4B–183** 551.551:551.501.6

Johannessen, Thor Werner, **Some computations of the atmospheric turbulence.** *Meteoro- ɔgiske Annaler,* 3(2):14–58, **1949.** 5 figs., 11 tables, 8 refs., 61 eqs. **DWB**—A quantitative study f the physical structure and magnitude of turbulence eddies in air streams. Detailed formulas, raphs and computation tables are presented and discussed for eddy stresses and eddy convectivity moothed over a long period. Calculations may thus be made from hodographs representing the apse rate or shear in wind and temperature. Vertical and semilateral eddy convectivity due to arge scale and to frictional turbulence are treated individually. Little is known about the large cale eddies, but enough measurements have been made to approximate a theory of small scale eddies. (*Same item as* 10–105, Oct. 1950, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Turbulent xchange 3. Nomograms.**—*M. R.*

**4B–184** 551.584:551.511(02)

Laĭkhtman, D. L. and Chudnovskiĭ, A. F., **Fizika prizemnogo sloia atmosfery.** [Physics of he air layer near the ground.] Leningrad, Gosizdat., **1949.** 254 p. 50 figs., 19 tables, 72 refs., 33 eqs., append. **DLC**—A major theoretical and practical treatise on micrometeorology, based nainly on recent investigations of Soviet meteorologists and agrophysicists. A great deal of atten- ion is paid to the physical characteristics of the surface. The dynamics and thermodynamics of he microclimatic layer are treated in detail, with ample discussion of turbulent exchange and dissipa- ion of energy with respect to stability. The last three chapters consider wind structure and tur- ulent viscosity, temperature regime (vertical, diurnal and transformation of air masses), and water apor (evaporation, condensation, gradients and transport), and the instruments and observations of ach respectively. (For fuller abstract *see* 8–124, Aug. 1950, *MAB.*) *Subject Headings:* **1. Micro- neteorology 2. Turbulent exchange 3. Textbooks.**—*M. R.*

**4B–185** 551.511:551.551

Lettau, Heinz, **Isotropic and non-isotropic turbulence in the atmospheric surface layer.** *U. S. Air Force. Cambridge Research Laboratories, Geophysical Research Papers,* No. 1, Dec. **1949.** 86 p. 4 figs., 10 tables, 26 refs., 100 eqs. **DWB, MH-BH**—An important and thoroughgoing contribution o present knowledge of turbulence, micrometeorology and problems of energy exchange in the urface layer. Several chapters are devoted to a review of theories and definition of the terms nd parameters and to setting up the basic equations for isotropic and nonistropic turbulent flow. Surface layer; the three basic parameters: vertical mixing length ($l$), horizontal friction velocity Schubspannungsgeschwindigkeit) and vertical mixing velocity; and eddy stress, austausch coeffi- ient, etc.) Deficiencies in the theory and measurements are mentioned as fields for further study. A new dimensionless number has been defined, which differs slightly from Richardson's number which assumes "just no turbulence"). The wind profile is then expressed by a formula which educes to the logarithmic law for adiabatic conditions. This new theory explains the dependency f the basic factors on the heat flux or on temperature lapse rate, although it is proven that the oughness parameter does not depend on thermal stratification. Diurnal variations of the meteoro- ɔgical elements and turbulent fluctuations in the surface layer are also explained by this new sim- lified theory. In the final chapters the theory developed by the author is applied to turbulent eat flux as a constituent of the heat balance of the ground—specifically testing data obtained by HAUDE in the Gobi Desert, by SVERDRUP in the Arctic (Spitsbergen), and to the moisture exchange onsiderations of THORNTHWAITE and HOLZMAN. Lastly, the formation of radiation fog is considered n the light of the theory. The paper includes a large number of useful graphs or nomograms, as ell as definitions of terms and quantities in a mathematical and a descriptive manner. (*Same*

*item as* 7–37, July 1950, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Micrometeorology 3. Turbulent exchange 4. Glossaries.**—*M.R.*

**4B–186** 551.551:551.511

Ogiwara, Sekiji, **Effect of turbulent mixing on the adiabatic lapse rate of the air temperature. (I. Dry air.)** *Meteorological Society of Japan, Journal*, 27:135–140, May **1949.** 4 figs., 2 refs., 12 eqs. In Japanese, English abstract p. 17. **DWB**—Applying aerodynamical theory of the jet from circular nozzle, author studies effect of turbulence on distribution of wind velocity and temperature in an ascending current of air. Calculations made. *Subject Headings:* **1. Turbulence in the frictional layer 2. Wind structure 3. Lapse rates.**—*From author's abstract.*

**4B–187** 551.584.41:551.551

Poppendiek, H. F., **Investigation of velocity and temperature profiles in air layers within and above trees and brush.** California University, Dept. of Engineering, March **1949.** 44 p. 13 figs., 3 tables, 7 refs., 29 eqs. **DWB**—Measurements of temperature, wind and stability made in and above an orchard, a brush field and a forest are compared with theoretical curves prepared on the basis of current ideas of boundary layer, turbulent exchange and roughness concepts. Measured velocities were predicted with an accuracy of about 15% for the three systems. *Subject Headings:* **1. Turbulence measurement 2. Forest influences 3. Wind profiles 4. Temperature profiles. I. California. University. Dept. of Engineering.**—*M.R.*

**4B–188** 551.501.7 551.524.4

Prudhomme, André, **Les vitesses ascensionnelles des ballons de radiosondage.** [The rate of ascent of radiosonde balloons.] *Annales de Géophysique*, 5(3):225–232, July–Sept. **1949.** 2 figs., 28 refs., eqs. **MH-BH**—This is a study of the relationship between the vertical gradient of atmospheric temperature and the rate of ascent of radiosonde balloons. The method for calculating the mean rate of ascent and determining variations from it is described. Correlation coefficients calculated between vertical temperature and rates of ascent indicate that variations in rates of ascent are not caused by large scale vertical air movements but by the effect of air temperature upon the specific resistance of the balloon. The nature of the temperature gradient associated with intense variations of rates of ascent is described. The rate of ascent varies when the Reynolds number is between $2\times10^5$ and $5\times10^5$ C.G.S. Variations in the rates of ascent of balloons by night and day are compared. (*Same abstract as* 2.2–18, Feb. 1951, *MAB.*) *Subject Headings:* **1. Balloon ascension rates 2. Atmospheric turbulence 3. Vertical temperature gradient.**—*I. L. D.*

**4B–189** 551.551:551.524.4

Priestley, C. H. B. and Swinbank, W. C., **Vertical transport of heat by turbulence in the atmosphere.** *Royal Society of London, Proceedings, Ser. A*, 189(1019):543–561, June 3, **1947.** fig. 15 refs., 6 eqs. **DWB**—It is shown that a component of heat flux, here called "convective turbulence," must result from the buoyancy forces. This is always directed upward and is thus opposed to the general downward transfer of mechanical turbulence. Temperature records show that convective turbulence may at times completely dominate the direction of the flow of heat, a conclusion which is supported by reference to some synoptic examples. This result helps explain the normal increase of potential temperature with height. The turbulent transfer of physical quantities other than heat is briefly considered. *Subject Heading:* **1. Turbulent transfer of heat.**

**4B–190** 551.55

Richardson, E. G., **The use of smoke in the study of atmospheric movements.** *Weather* 4(10):334–336, **1949.** 2 plates. **DWB**—Discussed are applications of smoke to the study of local atmospheric motions comprising areas ranging from a few square inches to a hundred square feet. (*Same item as* A–236, Jan. 1950, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Smoke dispersion.**—*H.P.K.*

**4B–191** 551.551 551.58

Sapozhnikov, A. A., **Nekotorye vyvody iz statsionarnykh nabliudenii v prizemnom sloe vozdukha nad skorost'iu vetra i temperaturoi vozdukha.** [Some conclusions from stationary observations of the wind velocity and air temperature in the layer near the ground.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Trudy Nauchno-issledovatel'skikh Uchrezhdeniĭ, Ser. I, Meteorologiia* No. 25, Fizika Prizemnogo Sloia Atmosfery, p. 68–86, **1947.** 9 figs., 5 tables, 3 refs. **DLC**—Special observations at noon and midnight were made daily for a year by the Central Geophysical Observatory in 10 different zones of the U.S.S.R. in 1943 (wind velocity up to 7 m and temperature differences 20–150 cm). Description of the locations of observation points are given and the accuracy of measurements is analyzed. It is concluded that characteristics of air temperature and wind velocity variations depend on the state of surface cover, weather conditions, radiation, and on

the climatic zone. *Subject Headings:* **1. Microclimatology 2. Air temperatures 3. Wind profiles 4. U.S.S.R.**—*N.T.Z.*

**4B–192** 551.511:551.551(02)

†Schlichting, H., **Lecture Series "Boundary Layer Theory." Part II—Turbulent flows.** *U. S. NACA, Technical Memorandum* No. 1218, April **1949.** 46 figs., 2 tables, 56 refs., numerous eqs. Trans. of: **Vortragsreihe Grenzschichttheorie. Teil B. Turbulente Strömungen. DLC**—A comprehensive review of turbulence theory dealing mostly with technical problems. Of interest to meteorologists are discussions of basic problems concerning the origin of turbulence, mixing length, free turbulence, the ratios between exchange of momentum, heat and matter, perturbation differential equations, boundary value problems, etc. *Subject Headings:* **1. Turbulence theory 2. Boundary layer 3. Textbooks.**—*A.A.*

**4B–193** 551.551:551.511

Schmitz, Hans Peter, **Über die Änderung der Turbulenzenergie.** [On the change of the energy of turbulence.] *Zeitschrift für Meteorologie,* 2(11):338–339, Nov. **1948.** 9 refs., 25 eqs. Review by Leslie S. G. Kovasznay in: *Applied Mechanics Reviews,* 2(8):185, Aug. **1949. DWB**—Expression of equations for the change in kinetic energy in a field of turbulent diffusion (in the atmosphere) in a form which is analogous to that for viscous dissipation (diffusion coefficient). Energy is spent either in viscous dissipation on the one hand or in increasing kinetic energy of turbulence or in turbulent mass transport, on the other hand. *Subject Headings:* **1. Turbulent exchange 2. Energy exchange 3. Turbulent transfer of mass. I. Kovasznay, Leslie S. G.**—*M.R.*

**4B–194** 551.510.42:551.588.7

Sheleĭkhovskiĭ, G. V., **Zadymlenie gorodov.** [Smoke in cities.] Moscow, Ministerstvo Komunal'nogo Khoziaĭstva, **1949.** 234 p. 96 figs., 44 tables, 72 refs., 328 eqs. **DLC**—Useful experimental as well as theoretical information on the dispersion of smoke and gases in cities or industrial areas. Methods of measuring and charting the horizontal and vertical structure of smoke emitted by a stack are treated in considerable detail. Several chapters give the theory of dispersion of smoke and gases under varying conditions of wind, lapse rate, turbulence, stack height, practical size, or type of gas. The theory is profusely supported by tables and charts based on empirical field or laboratory data. A series of recommendations is presented for use in town planning in the light of wind (frequency of direction and speed) and other meteorological conditions. (For fuller abstract *see item* 3G–248, July 1952, *MAB.*) *Subject Headings:* **1. Turbulent diffusion 2. Urban climatology 3. Visibility 4. Atmospheric pollution 5. Smoke abatement 6. Public health.**—*M.R.*

**4B–195** 551.551:551.511

Sheppard, P. A., **Wind structure and atmospheric turbulence, Part II. Theoretical studies.** *Science Progress,* London, 37(145):68–82, Jan. **1949. DLC**—Treats of the equation of diffusion; the flux equations and the diffusivity as function of height near the ground; diffusivity in large scale flow patterns in the free atmosphere; the heat flux equation; Richardson's criterion of turbulence. (*Same item as* 1–100, Jan. 1950, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Wind structure.**

**4B–196** 551.510.42:551.551

Sherwood, T. K., **The geometry of smoke screens.** *Journal of Meteorology,* 6(6):416–419, Dec. **1949.** 5 figs., 3 refs., 9 eqs. **DWB**—Application of SUTTON's theory of turbulent dispersal to the problem of determining the form and dimensions of an artificial smoke cloud after a given time lapse. The clouds are ejected from smoke generators and data obtained therefrom can be used in checking turbulence theories as well as vice versa. Nomograms are given for predicting concentrations and patterns downwind for single and multiple generator screens. (*Same item as* 3–40, March 1950, *MAB.*) *Subject Headings:* **1. Turbulence measurement 2. Smoke screens.**

**4B–197** 551.551

Shiotani, Masao and Yamamoto, Gi-ichi, **Atmospheric turbulence near the ground, I, II.** *Meteorological Society of Japan, Journal, 2nd Ser.,* 27:73–77, 219–224, March, July **1949.** 5 figs., tables, 3 refs. In Japanese, English summary. **DWB**—Investigation of turbulence at Wakkanai with hot wire anemometers. No relation seen between wind structure and change in lapse rate of air temperature accompanying solar eclipse. *Subject Headings:* **1. Turbulence measurement 2. Hot wire anemometers 3. Micrometeorological turbulence 4. Japan.**—*H.P.K.*

**4B–198** 551.508.54

Simmons, L. F. G., **A shielded hot-wire anemometer for low speeds.** *Journal of Scientific Instruments,* London, 26(11):407–41, Nov. 1949. 7 figs., 2 refs. **DLC**—A low-speed anemometer

is described which comprises an electrically heated wire and a thermocouple contained in a double-bore silica tube. In an air current the temperature change caused by heat loss is registered by the thermocouple and, when the instrument is suitably calibrated, the e.m.f. developed serves as a measure of the speed of flow. *Subject Heading:* **1. Hot wire anemometers.**—*Author's abstract.*

**4B–199** 551.551:551.554

Sutton, O. G., **The application to micrometeorology of the theory of turbulent flow over rough surfaces.** *Royal Meteorological Society, Quarterly Journal*, 75(326):335–350, Oct. **1949.** 3 tables, 9 refs., 36 eqs. **DWB**—This important mathematical paper extends the theory of turbulent flow of rough surfaces. For the boundary surface layer the author introduces the concept of "friction velocity" $u_*$, defined as root (shearing stress/density) and deduces that

$$\frac{\bar{u}}{u}=\frac{I}{k}\log_e\left(\frac{u_* z}{v}\right)+\text{const.} \qquad (7)$$

$\bar{u}$ = mean velocity, $v$ is kinematic velocity. In meteorology $u_*$ is approximately $\bar{u}/10$. Over a "rough" surface (one in which the irregularities project through the laminar layer) viscosity can be ignored, and Sutton derives an expression (9) resembling that of Rossby and Montgomery (1935) (13), involving the "roughness length" $z_0$ (taken as 1/30 of average diameter of obstacles), but neither (9) nor (13) approach (7) for $z_0=0$. To obtain a generally applicable expression, he introduces "macroviscosity" $N=u_* z_0$, giving

$$\frac{\bar{u}}{u_*}=\frac{I}{k}\log_e\left(\frac{u_* z N}{Nv/9}\right) \qquad (17)$$

The corresponding power law of wind profile is given (20). $N$ specifies the quality of a surface better than $z_0$. Table I gives values of $u_*$, $z_0$ and $N$ for various surfaces; only ice and calm sea are aerodynamically smooth for winds of 5 m/s at 2 m height. Part II deals with diffusion over rough surfaces, deriving lateral and vertical "generalized diffusion coefficients" (32, 33) for use in studying, e.g., concentration of impurities; these are found to agree well enough with observations. (*Same abstract as* 2–123, Feb. 1950, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Roughness parameters 3. Micrometeorology.**—*C.E.P.B.*

**4B–200** 551.551:551.554

*Takeda, K., **On the atmospheric turbulence, 1st paper. The vertical distribution of the wind velocity near the earth's surface, I and II.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 27(11,12):333–341, 363–370, Nov., Dec. **1949.** 10 figs., 4 tables, 16 refs., 29 eqs. In Japanese, English summaries on pp. 37, 39. **MH-BH**—In the first part the author reviews turbulence theory. Results of 19 measurements of wind and temperature profile (0.5, 1.0, 2.0 and 5.0 m above ground) analyzed and compared with data obtained by others and with formulas of Hellmann, Heywood and Best. The conclusion is that the wind velocity follows the simple logarithmic law $u=\alpha \log \frac{z}{z_0}$ when $\alpha$ depends only on velocity and $z_0$ on stability. In the second part the data are presented graphically and a new formula deduced for eddy viscosity: $K_s=\frac{K}{1+BR_i}$. The author supports Sutton's theory on velocity distribution. *Subject Headings:* **1. Turbulence theory 2. Wind profiles.**—*M.R.*

**4B–201** 551.576.1:551.511

Villa, Eduardo, **Diffusione del vapore nell'atmosfera. Nubi per diffusione.** [Diffusion of vapor in the atmosphere. Clouds formed by diffusion.] *Rivista di Meteorologia Aeronautica*, 9(3):21–34, July–Sept. **1949.** 2 figs., 5 refs., 11 eqs. Italian, French, English and German summaries p. 21. **MH-BH**—Molecular diffusion in the atmosphere is compared with eddy diffusion and the theories developed and applied to the problem of the evaporation of fog and the rate of growth of clouds. The laws of turbulent diffusion in the lower layers over the sea are set up graphically and applications made to show that clouds can form by means of diffusion in homogeneous stable air masses (such as *mT* air). (*Same item as* 4–106, April 1950, *MAB.*) *Subject Headings:* **1. Cloud formation 2. Turbulent exchange 3. Turbulent diffusion.**

**4B–202** 551.551

Wieghardt, Karl, **Über Ausbreitungsvorgänge im Bodenwind.** [On diffusion processes in surface wind.] *Meteorologische Rundschau*, 2(7–8):196–198, July–Aug. **1949.** fig., 2 tables, 7 refs., 17 eqs. **MH-BH**—Wind channel measurements of a temperature field behind a heat source are transferred to turbulent motion in a free atmosphere and represented by a nomogram. (*Same*

*tem as* 4–93, April 1950, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Turbulent diffusion.**—*C.E.P.B.*

## 1950

**4B–203** 551.551

Batchelor, G. K., **The application of the similarity theory of turbulence to atmospheric diffusion.** *Royal Meteorological Society, Quarterly Journal,* 76(328):133–146, April **1950.** 19 formulas, table. **DWB**—The paper draws attention to KOLMOGOROV's similarity theory of small scale structure of turbulent motion and its application to atmospheric and oceanic turbulence. Average properties of small eddies are determined by $\nu$ (kinematic viscosity) and $\epsilon$ (rate of dissipation per unit mass of fluid, energy being supplied by larger eddies), and in the inertial subrange only by $\epsilon$. The Reynolds numbers at which these principles hold are discussed. In the free air $(\nu^3/\epsilon)^{\frac{1}{4}}$ nearly = 0.2 cm and the inertial subrange is large (ca. 1 to 100+ meters). It is found that theory cannot be applied to diffusion from a fixed source, but is applicable to a moving source, and predictions of increase of mean square distance between particles are made. The results are compared with observations of diffusion of pairs of particles by DURST and RICHARDSON and STOMMEL and some agreement is found. Richardson's empirical proportionality between the diffusion coefficient $K$ and the 4/3 power of scale of observation is in general agreement with the theory. (*Same item as* 6–66, June 1950, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulent diffusion.**—*C.E.P.B.*

**4B–204** 551.524.31:551.551

Berliand, O. S., **Utochnennaia teoriia sutochnogo khoda temperatury vozdukha s uchetom izmeneniia koeffitsienta turbulentnoĭ teploprovodnosti v techenie sutok.** [A more exact theory of the diurnal variation in air temperature, considering the diurnal variation in the coefficient of turbulent diffusion of heat.] *Akademiia Nauk, SSSR, Izvestiia, Ser. Geogr. i Geofiz.,* 14(1):70–81, Jan.–Feb. **1950.** 2 figs., 3 tables, 4 refs., 35 eqs. **DLC**—The differential equations of eddy diffusion of heat are solved and the solution presented step by step. It is assumed that the coefficient of turbulent heat transport is a linear function of height and time of day or night. Radiant heat exchange is ignored in this solution. (*Same item as* 2.1–108, Jan. 1951, *MAB.*) *Subject Headings:* **1. Turbulent diffusion 2. Turbulent transfer of heat.**—*M.R.*

**4B–205** 551.551

Brier, Glenn W., **The statistical theory of turbulence and the problem of diffusion in the atmosphere.** *Journal of Meteorology,* 7(4):283–290, Aug. **1950.** 6 figs., table of symbols, 9 refs., 34 eqs. **MH-BH**—An extension of TAYLOR's and SUTTON's formulas for diffusion of particles from a point source has been made to take into account the initial distance between particles. The mathematic theory is developed at length followed by a description of an unsuccessful experiment performed (at Wilmington, Ohio, Nov. 1947) for about an hour and to 50 miles distance and 35,000 ft height, to determine the dispersion due to turbulence. (*Same item as* 2.1–117, Jan. 1951, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulent diffusion 3. Sounding balloons.**—*M.R.*

**4B–206** 551.524.4:551.551

Brocks, Karl, **Temperatur und Austausch in der untersten Atmosphäre.** [Temperature and exchange in the lowest atmosphere.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte,* No. 12:166–170, **1950.** 4 figs., 16 refs., eqs. **MH-BH**—The vertical variation with temperature in the lowest layer (up to over 100 m) depends on lability or stability (inversion) due to ground-air temperature difference. The height function of potential temperature follows a power law with negative index in labile and positive in stable air, and is a measure of vertical exchange. The frequency distribution of the indexes at different heights is shown in diagrams. (*Same item as* 9–87, Sept. 1950, *MAB.*) *Subject Headings:* **1. Lapse rates 2. Turbulent exchange.**—*C.E.P.B.*

**4B–207** 551.571.4 551.551

Bunker, Andrew F., **Diffusion of water vapor through a strong turbulence inversion.** Woods Hole Oceanographic Institution, Marine Meteorology, Contract N6onr-277, Technical Report 6, May **1950.** 11 p. 5 figs., 5 tables, refs., 6 eqs. **DWB**—The rates of water vapor diffusion through the base and the top of a turbulence inversion are computed from radiosonde humidity measurements. Values of the coefficient of turbulent mass exchange are tabulated and the subsidence of air masses considered. *Subject Headings:* **1. Turbulent diffusion 2. Turbulent transfer of water vapor. I. Woods Hole Oceanographic Institution II. Contract N6onr-277.**—*M.P.K.*

**4B–208** 551.551

California. University at Los Angeles. Dept. of Meteorology, **Diffusion in the free atmosphere.** Contract W28-099ac-439, Tenth Progress Report, Dec. 15, **1950.** 10 p. 2 figs., refs.

**DWB**—Turbulent diffusion in the free air was studied by means of hundreds of 2″ soap bubbles released from a generator suspended 100 ft below a captive balloon at an elevation of 1000 ft above a smooth, dry lake bed on the Mojave Desert in California at a time when surface wind speeds were <5 mi/h and the atmosphere was quite stable with the nocturnal inversion between the ground and the observation level. Wind and temperature profiles as well as photographs of the bubbles are used in calculations to test TAYLOR's theory. Curves based on this initial test agree well with TAYLOR's obtained from balloon cluster releases (1921). (*Same item as* 3.3–154, March 1952, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Turbulent diffusion 3. Soap bubble releases 4. Mojave Desert, California. I. Edinger, James G. II. Contract W28-099ac-439.**—*M.R.*

**4B–209** 551.573:551.577.11

Dady, G., **L'évaporation des goutelettes d'eau.** [Evaporation of water droplets.] *Journal Scientifique de la Météorologie*, Paris, 2(8):108–120, Oct.–Dec. **1950.** 7 figs., 3 tables, 4 refs., 26 eqs. French, English and Spanish summaries p. 108. **MH-BH**—The theory of rate of evaporation of freely falling drops of water is presented in detail. A graphical and tabular comparison of the theoretical rates as calculated from formulas of HOUGHTON, BOUSSINESQ and FRENKEL is given and the conclusion made that HOUGHTON's theory best fits the experimental data for all drop sizes and the BOUSSINESQ theory holds for drops <40$\mu$ diameter. Apparatus described and illustrated. Effect of turbulence fully considered in theory. (*Same item as* 2.3–116, March 1951, *MAB.*) *Subject Headings:* **1. Evaporation of raindrops 2. Atmospheric turbulence.**—*M.R.*

**4B–210** 551.511 551.551 551.573

Davies, D. R., **A note on three-dimensional turbulence and evaporation in the lower atmosphere.** *Royal Society of London, Proceedings, Ser. A*, 202(1068):96–103, June 22, **1950.** 2 tables, 8 refs. 4 eqs. **DLC**—CALDER (*see* 4B–175 above) worked out the theory for vertical distribution of vapor down wind from a short grass *plane* surface which is uniformly wetted. He allowed for aerodynamic roughness, but assumed adiabatic conditions. DEACON (1949) extended this theory to cover non-adiabatic conditions, and SUTTON (1949) applied his statistical theory to cover three-dimensional diffusion from a continuous point source. The author now applies his earlier (1947) three-dimensional model of turbulence to the above problem, to determine the vertical distribution of vapor at the down wind edge of a parabolic area and incidentally to determine the *evaporation* from a *finite* area. He gets good agreement between theory and observation for points above or not too far removed from the area in question. Finally, the formal connection between the two- and the three-dimensional theories is shown mathematically and the results of measurements are compared with calculations for 1, 8, 24 and 48 inches above and 0, 2.5 and 5.0 yards from the axis of an area 10 yards across. (*Same item as* 10–58, Oct. 1950 and No. K–188, Nov. 1950, *MAB.*) *Subject Headings.* **1. Turbulent transfer of moisture 2. Evaporation.**—*M.R.*

**4B–211** 551.551:551.573

Davies, D. R., **Three-dimensional turbulence and evaporation in the lower atmosphere. I. II.** *Quarterly Journal of Mechanics and Applied Mathematics*, Oxford, 3(1):51–73, March **1950.** table, 80 eqs. **DLC**—The investigation extends O. G. SUTTON's theory of evaporation in a turbulent air stream from a plane saturated liquid surface to a finite rectangular lake, introducing lateral diffusivity. In Part I a mathematical solutation is obtained which is applicable to any evaporating area. In Part II a power law of variation of diffusivity with height, incorporating the lateral effect is determined by theory in the form:

$$K_y = a_y U_1^{1-n} z^{\alpha}$$

where $\alpha$, $n$ are determinable constants for a given turbulent state and $a_y$ depends on $\alpha$. This is applied to evaporation from a finite area and good agreement is obtained with observations, but a complete solution is not yet practicable. (*Same item as* 8–75, Aug. 1950, *MAB.*) *Subject Headings.* **1. Evaporation 2. Turbulent transfer of moisture 3. Lateral exchange.**—*C.E.P.B.*

**4B–212** 551.551

Franke, M., **Bemerkungen über die Zeit- und Höhenabhängigkeit des Austauschkoeffizienten (Vorläufige Mitteilung).** [Remarks on the relation of the austausch coefficient to time and height (Advance communication).] *Annalen der Meteorologie*, 3(3–4):118–119, **1950. DWB, MH-BH**—Relation of austausch coefficient to height is not linear but follows probability integral on any one occasion. Variations are discussed. (*Same item as* 8–76, Aug. 1950, *MAB.*) *Subject Headings* **1. Atmospheric turbulence 2. Turbulent exchange.**—*C.E.P.B.*

**4B–213** 551.571.4 551.573

Frankenberger, Ernst, **Über das vertikale Gefälle der Luftfeuchtigkeit und die Verdunstung bei Quickborn/Holst.** [On the vertical gradient of humidity and evaporation at Quickborn/Hol-

stein.] *Germany. Deutscher Wetterdienst in der US-Zone, Berichte*, No. 12, p. 45–51, **1950.** 4 figs., table, refs., eqs. **MH-BH**—Specific humidity measured hourly at 2, 13, 28 and 70 m height on 29 days, using electrically ventilated instruments. These gave the austausch coefficients at various heights and temperatures. The ratio 1.4:1 between vertical coefficients for heat and humidity, and for momentum, was confirmed. Evaporation was calculated from humidity gradient and austausch coefficient for rain days and days with wet and dry ground. (*Same item as* 9–107, Sept. 1950, *MAB.*) *Subject Headings:* **1. Humidity lapse rate 2. Evaporation 3. Turbulent exchange.**—*C.E.P.B.*

**4B–214** 551.551 551.584(02)

†Geiger, Rudolf, **Das Klima der bodennahen Luftschicht. Ein Lehrbuch the Mikroklimatologie.** [The climate near the ground. A textbook of microclimatology.] 3rd ed. rev. and enl. Braunschweig, Vieweg, **1950.** 460 p. 195 figs., tables, bibliog. p. 408–446. **DWB.** English trans. of 2nd ed. by M. N. Stewart and others. Cambridge, Harvard Univ. Press, **1950. DLC**—The first half of this very complete survey of the lowest few meters of the atmosphere contains chapters on heat exchange, mass exchange, temperature conditions, moisture and wind conditions, and the influence of various surface roughness, character and heat conditions on microclimate. Pt. II treats of the relationships between microclimate and land forms, plants, animals and men. *Subject Headings:* **1. Microclimatology 2. Turbulent exchange 3. Textbooks. I. Stewart, Milroy N.** (*trans.*). —*M.P.K.*

**4B–215** 551.594.7:396.029.6

Gerhardt, John R. and Crain, Cullen M., **The direct measurement of the variation in the index of refraction of atmospheric air at microwave frequencies.** Texas. University, Electrical Engineering Research Laboratory, Contract N5ori-136, T.O.1, and Contract N6onr-266, T.O.2, Report No. 38, April 15, **1950.** 25 p. 16 figs., 13 refs. **DWB**—Variations in index of refraction of atmospheric air at microwave frequencies were measured with a specially constructed atmospheric refractometer which compares resonant frequency of a cavity through which air is drawn, with that of a closed reference cavity. Details of theory, construction, wiring and recording apparatus are given. Graphs show rapid fluctuations of temperature and wind speed which can be recorded. Records show marked correspondence between microwave index of refraction and air temperature as a function of height, insolation and soil moisture. *Subject Headings:* **1. Micrometeorology 2. Atmospheric refractometers 3. Turbulent fluctuations 4. Microwave propagation. I. Texas. University. Electrical Engineering Research Laboratory II. Contract N5ori-136. III. Contract N6onr-266.**—*From authors' abstract.*

**4B–216** 551.584:551.511

Gerhardt, John R. and Jehn, K. H., **Further studies of the turbulent transfer of heat near the earth's surface.** Texas. University. Electrical Engineering Research Laboratory, Report, No. 43, Nov. 30, **1950.** [n.p.] 29 figs., 7 tables, 7 refs. **DWB**—The eddy flux of heat is derived from micrometeorological data obtained at Manor, Texas on Aug. 3–4, 1948, Jan. 24–25, 1950 and Feb. 22–23, 1950, using theory presented by LETTAU. Computations include radiation and heat transfer from air to soil and vice versa, from temperature and wind profiles based on detailed measurements. A comprehensive presentation and analysis of data. (*Same item as* 2.11–165, Nov. 1951, *MAB.*) *Subject Headings:* **1. Micrometeorological profiles 2. Turbulent transfer of heat. I. Texas. University. Electrical Research Laboratory II. Contract N6onr-266.**—*M.R.*

**4B–217** 551.525.2:551.551

Guild, W. R., **Note on heat transfer at the soil surface.** *Journal of Meteorology*, 7(2):140–144, April **1950.** 4 figs., 12 refs., 4 eqs. **DWB, MH-BH**—Heat balance and eddy diffusion as determined from data obtained at night under desert conditions (in Arizona). Marked correlation exists between eddy diffusivity and wind speed. Convective term accounts for as much as half of the net transfer; hence, cannot be ignored. (*Same item as* 7–72, July 1950, *MAB.*) *Subject Headings:* **1. Radiational cooling 2. Turbulent transfer of heat 3. Turbulent diffusion 4. Arizona.**—*M.R.*

**4B–218** 551.551:523.2:523.4

Huang, Su-shu, **On turbulence of the atmospheres of the sun and the stars.** *Astrophysical Journal*, Chicago, 112(3):418–423, Nov. **1950.** fig., 13 refs., 12 eqs. **MH-BH**—Effect of large or small eddies on broadening absorption lines is discussed. Size of fastest moving eddies most important. Variation from star to star described and turbulent spectrum of sun (based on observed data) discussed and illustrated. (*Same item as* 2.3–105, March 1951, *MAB.*) *Subject Headings:* **1. Turbulence spectrum 2. Stellar atmospheres 3. Solar atmosphere.**—*M.R.*

**4B–219** 551.511:551.551:551.46

Inoue, Ei-ichi, **Interrelation between turbulent fields in ocean and atmosphere.** *Tokyo. University. Geophysical Institute, Geophysical Notes*, 3(36), **1950.** 3 p. 6 refs. 10 eqs. Also:

*Collected Meteorological Papers*, Tokyo, 2(2), Dec. **1950.** In English. **MH-BH**—Turbulent diffusion coefficient in sea $K_s$ and in air $K_a$ are both forms of $E^{1/3}L^{4/3}$ where $E$ is dissipation rate of eddy energy and $L$ is scale. Taking $E_s$ as 0.08 and $E_a$ as 5 cm²/sec³ author calculates $K_s$ and $K_a$. He finds that length of smallest eddy in the ocean is of the same order as in the atmosphere. *Subject Headings:* **1. Turbulent diffusion 2. Turbulent exchange 3. Oceanic eddies.**—*C.E.P.B.*

**4B–220** 551.551

Inoue, Ei-ichi, **On the turbulent diffusion in the atmosphere (I).** *Meteorological Society of Japan, Journal, 2nd Ser.*, 28(12):441–456, Dec. **1950.** 6 figs., 12 refs., 55 eqs. In English. **MH-BH**—Author defincs a term "turbulon" for an element of nonlaminar flow (nearly equivalent to eddy). Turbulent diffusion is discussed as the irregular motion of turbulons, interacting by turbulent friction. Various properties are examined, including the proportionality of scale and velocity, rate of dissipation of energy, and the difference between the smallest turbulon and the smallest eddy as defined by TAYLOR. (*Same item as* 2.7–114, July 1951, *MAB.*) *Subject Headings:* **1. Turbulent diffusion 2. Atmospheric eddies.**—*C.E.P.B.*

**4B–221** 551.511 551.551

IUdin, M. I., **Nekotorye voprosy teorii meteorologischeskikh poleĭ.** [Some problems of the theory of meteorological fields.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, 19(81):288–314, **1950.** 2 figs., 4 tables, 26 refs., 51+eqs. **DLC**—A lengthy discussion of the application of theory of turbulent motion to physical (especially atmospheric) media. Optimum conditions in time and space, for use of theoretical determinations, and variations from these optimum conditions, the structure of the temperature and pressure fields and lastly errors in interpolation for space or time in temperature or wind. Calculations are treated theoretically and empirically in the light of the statistical theory of turbulence. *Subjec Headings:* **1. Statistical theory of turbulence 2. Atmospheric turbulence.**—*M.R.*

**4B–222** 551.551:551.556.2:632.1

IUdin, M. I., **Vliianie lesnych polos na turbulentnyĭ obmen i optimal'naia shirina polos.** [Influence of the shelter belts on turbulent exchange and the optimal width of the belts.] *Akademiia Nauk, SSSR, Doklady*, 71(4):655–658, April **1950.** 6 refs., 5 eqs. **DLC**—A shelter belt reduces not only the wind speed but what is more important for agriculture, it reduces the turbulent exchange by breaking up the big eddies and forming many small random eddies. Experiments made in 1949 by the Div. of Applied Meteorology of the Central Geophysical Observatory (Leningrad), in connection with theoretical calculations, lead to the conclusion that for belts of sparse trees the optimum width would be from 8 to 25 meters. (*Same item as* 2.6–82, June 1951, *MAB.*) *Subject Headings:* **1. Turbulent exchange 2. Shelter belts.**—*M.R.*

**4B–223** 551.511:551.584

Jehn, K. H. and Gerhardt, J. R., **A preliminary study of the eddy transfer of heat near the earth's surface.** *Journal of Meteorology*, 7(5):343–346, Oct. **1950.** 5 figs., 5 refs., 5 eqs. **MH-BH**—Results of studies made at the Manor Micrometeorological Field Station in Texas on Aug. 3 and 4, 1948 compared with data obtained in Southern Arizona and at Leafield, England, on the time and height distribution of eddy conductivity as calculated from the temperature, moisture and wind from the ground up to 300 ft. The equation of eddy heat transfer is developed, the heat transfer at the soil surface discussed and finally, the diurnal variation of $K_H$ calculated for several levels. (*Same as item* 2.3–55, March 1951, *MAB.*) *Subject Headings:* **1. Micrometeorological profiles 2. Turbulent transfer of heat 3. Texas 4. Arizona.**—*M.R.*

**4B–224** 551.511:551.554

Kopcewicz, T., **O wpływie lepkości turbulencyjnej powietrza na pionowy rozkład wiatru w tarciowej warstwie atmosfery Ziemi.** [Influence of eddy viscosity on the vertical distribution of wind in the frictional layer of the earth's atmosphere.] *Poland. Państwowy Instytut Hydrologiczno-Meteorologiczny, Wiadomości Służby Hydrologicznej i Meteorologicznej*, 3(1):5–42, **1950.** 6 figs., 6 tables, eqs. **DWB**—A highly theoretical paper in which some of the well-known theories (ERTEL, SIEBER-MÖLLER, BRUNT, PRANDTL, ROSSBY, etc.) are summarized. The author discusses the equations of motion, and investigates the movement of air in the frictional layer, comparing the theory with results of observations of wind direction and velocity as a function of altitude. *Subject Headings:* **1. Friction layer 2. Wind deviation 3. Ekman's spiral.**—*A.M.P.*

**4B–225** 551.511:551.551

Lettau, Heinz, **A re-examination of the "Leipzig Wind Profile" considering some relations between wind and turbulence in the frictional layer.** *Tellus*, 2(2):125–129, May **1950.** 3 figs., 3 tables, 5 refs., 20 eqs. **MH-BH**—LETTAU has made a more accurate determination of the wind

leviation from the geostrophic wind from the "Leipzig Profile" and using the average *austausch* listribution obtained by three different formulas, arrived at the conclusion that: "The energy for naintaining turbulence in a steady frictional wind profile is taken from the potential energy of the iorizontal pressure field by means of the steady flow of air across the isobars." Computations by he three methods are tabulated, averaged and the standard deviation shown. (*Same item as* 11–58, Nov. 1950, *MAB.*) *Subject Headings:* **1. Turbulent exchange 2. Wind deviation 3. Leipzig profile 4. Frictional effects.**—*M.R.*

**4B–226** 551.511

Liapin, E. S., **O giperbolicheskom uravnenii vertikal'nogo turbulentnogo obmena v atmosfere.** [Hyperbolic equation of vertical turbulent exchange in the atmosphere.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, 19(81):175 184, **1950.** 2 figs., 8 refs., 15+eqs. **DLC**—Theoretical treatment. *Subject Headings:* **1. Turbulent exchange 2. Turbulence theory.**

**4B–227** 551.510.42:551.551

Lowry, Philip H., **The theoretical ground-level dose-rate from the radioargon emitted by the Brookhaven Reactor stack.** Upton, N. Y., Brookhaven National Laboratory, July **1950.** 33 p. 24 figs., 9 tables, 15 refs., 28 eqs. **DWB**—By means of theoretical and empirical data on weather (wind, turbulence, etc.) and oil fog concentration measurements, tables and templates were compiled and are presented for calculating the mean hourly ground-level concentration of $A^{41}$ during various meteorological conditions for distances up to 15 km from the stack. The factors considered are rate of emission, exit velocity from stack, height and diameter of stack, mean wind speed and direction, type of gustiness and mean hourly direction distribution. The instantaneous maximum concentration as a function of distance is also mentioned. Results applicable to any similar installation in flat terrain, regardless of height of stack. (*Same item as* 3.7–83, July 1952, *MAB.*) *Subject Headings:* **1. Turbulent diffusion 2. Atmospheric pollution 3. Radioargon concentration 4. Industrial hygiene 5. Brookhaven, New York.**—*M.R.*

**4B–228** 551.551

Lucke, O., **Bemerkungen zur Definition des Austauschtensors. I.** [Remarks on the definition of the austausch tensor. I.] *Zeitschrift für Meteorologie*, 4(7–8):216–222, July–Aug. **1950.** 2 figs., 11 refs., 34 eqs. **MH-BH**—Author defines the austausch tensor for any property of air as the mean tensor product of the turbulent velocity and the vector along which that property retains its value. This agrees with G. I. Taylor if the turbulent flow is built up of limited cells of laminar flow, and with Ertel if the time intervals is limited. There follows a mathematical development under certain assumptions as to nonpersistent acceleration, leading to an evaluation of the persistence innate in variations of wind velocity, and to an expression connecting the austausch tensor with the most important observed magnitudes; it is proportional to the scatter matrix of the property. (*Same as item* 2.5–109, May 1951, *MAB.*) *Subject Headings:* **1. Austausch theory 2. Turbulent exchange.** —*C.E.P.B.*

**4B–229** 551.551:551.593.12:551.594.7

Megaw, E. C. S., **Scattering of electromagnetic waves by atmospheric turbulence.** *Nature*, London, 166(4235):1100–1104, Dec. 30, **1950.** 2 figs., 2 tables, 18 refs. **DLC**—Author first discusses spectra of stellar scintillation due to variable atmospheric refraction. Angular fluctuations near the zeniths how that density variation increases roughly as $t^{\frac{1}{3}}$ for periods of 1–50 seconds as required by Kolmogorov's theory (1941); above this it varies as $t^{\frac{1}{2}}$. He assumes that all the observations can be accounted for by an average spectrum of turbulence which is a permanent characteristic of the atmosphere. He then considers the scattering of short radio waves by atmospheric turbulence on the basis of observed scattering of a 10 cm. wave over 0–300 sea miles. This agrees with the theory of Booker and Gordon and with that derived from the scintillation spectrum. (*Same item as* 2.3–106, March 1951, *MAB.*) *Subject Headings:* **1. Turbulence spectrum 2. Scintillation 3. Radio transmission.**—*C.E.P.B.*

**4B–230** 551.511 551.551

Monin, A. S., **Dinamicheskaia turbulentsiia v atmosfere.** [Dynamic turbulence in the atmosphere.] *Akademiia Nauk, SSSR, Izvestiia, Ser. Geograficheskaia i Geofizicheskaia*, 14:232–254, **1950.** 3 figs., 8 tables, 31 eqs., bibliog. p. 254, abstract p. 232. In Russian. **DLC**—The author discusses the application of the statistical theory of turbulence given by Kolmogorov to atmospheric problems, examines the effect of hypothetical assumptions for the dependence of mixing length on height and gives solutions for the distribution of a steady wind in the friction layer of the atmosphere. Universal functions and numerical solutions are given for the wind distribution dependent on the coefficient of turbulent viscosity and the friction velocity using the balance equations of turbulent energy and assuming a thermally homogeneous atmosphere. The declination angle ($\alpha$) of wind

near the surface from the gradient wind is discussed in detail. The calculated dependence of $\alpha$ on the roughness parameter $Z_0$ is quite reasonable, but the author has difficulties in giving a theoretical explanation for greater deviation angles. *Subject Headings:* **1. Statistical theory of turbulence 2. Atmospheric turbulence 3. Kolmogorov's theory 4. Surface wind deviation.**—*A.A.*

**4B–231** 551.551

Ogawara, M., **On the form of turbulent vortex near the earth's surface.** *Geophysical Magazine*, Tokyo, 21(3):226–244, March **1950.** 10 figs., tables, 3 refs., 40 eqs. **MH-BH**—This is a theoretical discussion of turbulence in the free atmosphere. The nature of turbulence can be determined by classifying it into several categories according to the dimensions of velocity fluctuations and by studying the turbulent motion of one scale in relation to that of the next larger scale. Extremely small scale turbulence and large scale turbulence were analyzed by means of the theory of stochastic process for vortex systems and by means of the theory of time series. (*Same item as* 11–102, Nov. 1950, *MAB.*) *Subject Heading:* **1. Atmospheric turbulence**

**4B–232** 551.511:551.551

Ogiwara, Sekiji, **The vertical transfer of heat and the change of air temperature by turbulence.** *Tohoku University, Science Reports, 5th Series, Geophysics*, 2(1):44–47, March **1950.** fig., ref., 14 eqs. In English. **MH-BH.** Also: *Meteorological Society of Japan, Journal, 2nd Ser.*, 28(2):66–70, Feb. **1950.** fig., table, 2 refs., 15 eqs. In Japanese, English summary p. 70. **DWB**—The author attempts to improve on G. I. TAYLOR's formula for expressing turbulent heat transfer by taking into consideration the transfer of mass due to change in pressure gradient as lapse rate changes. Results compared with TAYLOR's when applied to data for Lindenberg and the Grand Banks (Newfoundland). Conclusions is that $K$ is constant only below 500 m, and increases with height when TAYLOR's formula is used; but the author's $K$ is constant to great heights. (*Same item as* 2.1–70, Jan. 1951, *MAB; see also item* 2.4–71, April 1951, *MAB.*) *Subject Headings:* **1. Turbulent exchange 2. Atmospheric turbulence 3. Vertical temperature gradient.**—*M.R.*

**4B–233** 551.551

Ogura, Y., **On the atmospheric turbulence (I).** *Tokyo. University. Geophysical Institute, Geophysical Notes*, 3(26), **1950.** 8 p. 8 figs., 5 refs., 5 eqs. Also: *Collected Meteorological Papers*, Tokyo, 2(2), Dec. **1950.** In English. **MH-BH**—A theoretical expression for autocorrelation of turbulence, assumed isotropic, at various time intervals is obtained and agrees with hot wire data at 38 m. The energy spectrum shows that most of the turbulence has a period less than 20 sec. An expression is found for intensity of turbulence calculated over time interval $T$, which agrees with observations. The relation, eddy diffusivity is nearly proportional to $T^{4/3}$, is verified. *Subject Heading:* **1. Turbulence statistics.**—*C.E.P.B.*

**4B–234** 551.524.4:551.551

Ogura, Y., **On the heat transfer in the lower layer of the atmosphere.** *Tokyo. University. Geographical Institute, Geophysical Notes*, 3(27), **1950.** 8 p. 9 figs., table, 5 refs., 27 eqs. Also: *Collected Meteorological Papers*, Tokyo, 2(2), Dec. **1950.** In English. **MH-BH**—After a strong night inversion with steep lapse above, surface air warms rapidly till inversion vanishes, then much more slowly, giving a flat daily maximum. A theoretical expression is developed for relation between maximum temperature and height of base of inversion but this does not agree with observations. In Pt. 2 author calculates thickness of turbulent boundary layer formed when wind blows from sea over a heated shore. It is found to depend only on distance from sea and roughness parameter $Z_0$. This was checked by observing vertical distribution (0–10 m) of wind velocity and temperature 30 m inland. Agreement good except with winds below 3–4 m/s when $Z_0$ became abruptly smaller. *Subject Headings:* **1. Vertical temperature gradient 2. Atmospheric turbulence 3. Turbulent transfer of heat.**—*C.E.P.B.*

**4B–235** 551.551:551.588.6

Pasquill, F., **The aerodynamic drag of grassland.** *Royal Society of London, Proceedings, Ser. A*, 202(1068):143–153, June 22, **1950.** 2 figs., table, 15 refs., 6 eqs. **DLC**—SHEPPARD's drag plate apparatus designed for use on a concrete surface, has been modified for measuring the aerodynamic drag over grass. The equipment is described and illustrated. Results of measurement over grass with winds of around 5 m/sec are tabulated for grass 1–5, 5–10 and 10–15 cm in length. Richardson's number ($Ri_{7.5}$) is computed for each 10 minute period and velocity profiles shown. Limitations due to presence of observer, lapse rate variations, etc. are mentioned. Limited data give evidence for validity of Reynold's formula for turbulent shearing stress in the ground layer of the atmosphere. Work is an extension of previous work by SHEPPARD (1947) on artificial drag over concrete and by SUTTON (1949) on diffusion in the lower atmosphere. (*Same item as* 10–104, Oct. 1950, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Surface roughness.**—*M.R.*

**4B–236** 551.511

Pasquill, F., **The turbulent exchange of water vapour, heat and momentum near the ground.** *Meteorological Magazine*, London, 79(933):81–85, March **1950. DWB**—Pasquill described investigations at Cambridge, England, to establish methods of deriving local rate of evaporation from a land surface by examination of turbulent exchange and energy exchange near the ground. Eddy diffusivity for momentum agrees with that for water vapor $K_v$ in adiabatic conditions. In unstable conditions eddy balance method of estimating evaporation, assuming $K_v$-$K_h$, may lead to overestimates. (*Same item as* 5–36, May 1950, *MAB.*) *Subject Headings:* **1. Turbulent diffusion 2. Evaporation from soil.**—*C.E.P.B.*

**4B–237** 551.511

†Poppendiek, H. F. and Vehrencamp, J. E., **Investigation of atmospheric diffusion processes by means of experimental, analytical, and numerical techniques.** California University, Dept. of Engineering, May **1950.** 54 p. 15 figs., 4 tables, 35 refs., 61 eqs. **DWB**—Heat, mass and momentum diffusion processes are investigated theoretically, statistically and experimentally in order to derive formulas which can be applied to problems of diffusion of atmospheric pollution, water vapor from seas, lakes, reservoirs and snow banks, heat and momentum from orchards, and smoke or gas from bombs. The basic theory of eddy diffusion is outlined, the experimental equipment for determining the diffusion, heat transfer and drag coefficients described and illustrated, analyses of actual cases presented, and sets of meteorological observations made in California, given in tables and graphs. A comparison is made between diffusion, drag and shear stress coefficients obtained in several countries in Germany, England and Texas. *Subject Headings:* **1. Turbulent diffusion 2. Statistical theory of turbulence. I. California University, Dept. of Engineering.**—*M.R.*

**4B–238** 551.524.4:551.554

Roll, Hans Ulrich, **Gedanken über den Zusammenhang der vertikalen Profile von Windgeschwindigkeit und Temperatur in der wassernahen Luftschicht.** [Ideas on the relation of the vertical profile of wind speed and temperature in the air layer near water.] *Annalen der Meteorologie*, 3(1–2):1–9, Jan.–Feb. **1950.** 5 figs. English summary p. 1. **DWB**—Observations at island of Neuwerk in North Sea at heights of 1–505 cm show logarithmic increases of wind speed with height. Some simultaneous temperature profiles show a logarithmic decrease. These support theory that in a height zone of a few meters ("sub-layer") shearing stress plays the decisive part in the vertical exchange mechanism and consequently wind and temperature distributions can be described by analogous logarithmic functions of height. Prandtl's law of a linear height function of mixing length applies independently of temperature stratification. The relation of this "sub-layer" to Rossby's 100 m "turbulent boundary" is not clear. Above the sub-layer in unstable conditions, thermal exchange due to vertical movement produces an adiabatic intermediate layer. (*Same item as* 6–60, June 1950, *MAB.*) *Subject Headings:* **1. Micrometeorological profiles 2. Turbulent exchange 3. Neuwerk Island, North Sea.**—*C.E.P.B.*

**4B–239** 551.551:551.508:551.524.4:551.554

Shiotani, Masao, **Turbulence in the lowest layer of the atmosphere.** *Tohoku. University, Science Reports, 5th Ser., Geophysics*, 2(3):157–200, Dec. **1950.** 32 figs., 14 tables, eqs., 38 refs. Also: *Meteorological Society of Japan, Journal, 2nd Ser.*, 28(5,6):167–177, 181, 187, May, June **1950. DWB**—A valuable paper important for practical investigations. Meteorological observations in the lowest 15 m of the atmosphere are compared with the statistical theory of turbulence. The vertical distribution of temperature, measured by a resistance thermometer, is given. The fluctuations of wind velocity were measured by hot wire anemometers. A description of the instruments used is given and errors in the measurement of air temperature are examined. The calculation of the mean energy of turbulence and other turbulence characteristics is made by the Hesselberg method. In summer the mixing length increases almost linearly with height; in winter it maintains a constant value upwards of 5 m. Correlations needed in theory are given, especially correlations of the velocity fluctuations with time, space and with the fluctuations of temperature. The spectrum of turbulence is examined, and the vertical component of the wind velocity is observed. The mean turbulence velocity seems to be directly proportional to the wind velocity. The material is extensive but not sufficient for drawing general conclusions. (*Same item as* 2.4–110, April 1951, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Wind fluctuations 3. Turbulent temperature fluctuations 4. Hot wire anemometers.**—*A.A.*

**4B–240** 551.551:551.588.7

Shiotani, Masao and Yamamoto, Gi-ichi, **Atmospheric turbulence over the large city—turbulence in the free atmosphere (2nd report).** *Geophysical Magazine*, Tokyo, 21(2):134–147, March **1950.** 10 figs., 6 tables, 10 refs., 7 eqs. **DWB**—Variations in wind velocity at various elevations were measured with a hot wire anemometer and were recorded with an electromagnetic oscillograph.

The mean wind velocity, the intensity and scale of turbulence, the spectrum of turbulence and eddy viscosity were calculated. The logarithmic law was found to fit the distribution of mean velocity. The intensity of turbulence, while fluctuating considerably, tended to diminish upwards; its frequency distribution was irregular. Both scale of turbulence and eddy viscosity showed high values and irregular frequencies of distribution because of unstable weather. (*Same item as* 10–106, Oct. 1950, *MAB.*) *Subject Headings:* **1. Turbulence in the frictional layer 2. Turbulence measurement 3. Urban climatology.**—*I.L.D.*

**4B–241** 551.551

Stewart, H. J. and MacCready, P. B., Jr., **Report on investigation of atmospheric turbulence.** California Institute of Technology, Pasadena, Contract No. Cwb-8118 and Cwb-8125, [Oct. 1950]. 127 p. 46 figs., 19 refs., eqs. **DWB**—Improved measurement techniques involving the use of two hot wire anemometers and a temperature wire resistance element mounted on a post or held in the air by a tethered balloon, are illustrated and described. Statistical analysis of the data indicated "that KOLMOGOROFF's similarity hypothesis is directly applicable to eddies of sizes ranging from under 10 cm to dimensions larger than the elevation of measurement." Heat and momentum flux measurements also made and analyzed. *Subject Headings:* **1. Turbulence measurement 2. Turbulent transfer of heat 3. Turbulent transfer of momentum. I. California Institute of Technology II. Contract No. Cwb-8118 III. Contract No. Cwb-8125.**—*M.P.K.*

**4B–242** 551.510.42:551.551

Sutton, O. G., **The dispersion of hot gases in the atmosphere.** *Journal of Meteorology*, 7(5):307–312, Oct. **1950.** 4 figs., 2 tables, 6 refs., 12 eqs. **MH-BH**—Behavior of a gas stream or jet in calm air and with horizontal wind movement is considered theoretically and the results compared with empirical data obtained in the laboratory by SCHMIDT. Finally, the effect of adding heat to a pollution source is formulated with the conclusion that in the absence of high winds, adding heat to the source has the same effect as increasing the height of the stack. (*Same item as* 2.3–45, March 1951, *MAB.*) *Subject Headings:* **1. Atmospheric pollution 2. Turbulent diffusion of gases.**—*M.R.*

**4B–243** 551.551:551.511

Timofeev, M. P., **O sutochnoĭ izmenchivosti turbulentnogo obmena.** [Diurnal variation of turbulent exchange.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 22(84):15–25, **1950.** 5 figs., 15 refs., 4 eqs. **DLC**—The equations of BUDYKO and of LAĬKHTMAN for calculating the coefficient of turbulence are discussed critically. By means of LAĬKHTMAN's formula, the diurnal variations of the coefficient of turbulence are calculated at heights of 1 m during different types of weather and during all seasons. All meteorological data were collected near Leningrad. During clear summer weather the coefficient of turbulence may vary daily 100 to 1000 times. The diurnal variations of the turbulence coefficient during changing and overcast weather are the same in all seasons. The characteristics of the coefficient can be explained by variations in wind velocity at a height of 1 m and the temperature difference at two levels. (*Same item as* 3.5–220, May 1952, *MAB.*) *Subject Headings:* **1. Diurnal exchange variations 2. Leningrad, U.S.S.R.**—*I.L.D.*

**4B–244** 551.511:532

Wrubel, Marshal H., **Turbulence and the curve of growth.** *Astrophysical Journal*, Chicago, 112(3):424–433, Nov. **1950.** 3 figs., 3 tables, 8 refs., 36 eqs. **MH-BH**—Although eddies of all sizes affect the absorption line contour, small eddies have greater effect upon the total absorption and the curve of growth. A weighting function $s(k)$ is derived for various circumstances of line formation. It is shown that all eddies of diameter smaller than two and a half times the scale height of the atmosphere appear in the curve of growth. Therefore, to explain the large differences observed in supergiant spectra between line contours and curves of growth, this theory requires a spectrum of turbulence with considerable energy in very long wave lengths. Such a spectrum may possibly be due to the effect which turbulence at deep layers may have upon the higher region of the atmosphere in which the lines are formed. (*Same item as* 2.3–108, March 1951, *MAB.*) *Subject Headings:* **1. Turbulence spectrum 2. Astrophysics.**—*Author's abstract.*

## 1951

**4B–245** 551.551:551.510.42

Barad, Morton L., **Diffusion of stack gases in very stable atmospheres.** *Meteorological Monographs*, Boston, 1(4):9–14, Nov. **1951.** 6 figs., 6 refs., eqs. **DWB**—Photographs of smoke plumes and measurements of concentration of stack gases at different distances downwind at Brookhaven, N. Y., show that the diffusion coefficient $K$ increases as the scale of the phenomenon increases and that during periods of high stability the range of eddy sizes is narrow, whereas during neutral equilibrium the range is wide. Thus the exchange coefficient determined during stable lapse rates is

representative of all such conditions. Rapid dilution is found to take place in the first few meters. Small eddies diffuse smoke plumes, whereas large eddies cause horizontal waves to form in the plume. Vertical extent of diffusion is shown to be less than horizontal, indicating non-isotropic turbulence. *Subject Headings:* **1. Turbulent diffusion of gases 2. Atmospheric pollution 3. Stability 4. Brookhaven, N. Y.**—*M.R.*

**4B–246** 551.551:551.511

Batchelor, G. K., **Turbulent diffusion.** *Maryland. University. Institute for Fluid Dynamics and Applied Mathematics, Lecture Series*, No. 4, April **1951.** 10 p. ref., eqs. **DWB**—The basic mechanism of turbulent diffusion, as it differs from molecular diffusion, is treated in this lecture. A complete solution is too complicated for practical purposes, but after several simplifications (assuming only the probability distribution of one marked particle, a statistically homogeneous field of turbulent motion, and insignificant molecular diffusion), the equations for probability distribution of $x(t)$, and the differential equation for mean concentration $Q(x, t, t_0)$ are developed. *Subject Headings:* **1. Turbulent diffusion 2. Statistical theory of turbulence 3. Lecture series. I. Pai, S. I.** *(ed.)*.—*M.R.*

**4B–247** 551.551 533.15

*California. University at Los Angeles, Dept. of Meteorology, **Diffusion in the free atmosphere.** Contract W28-099ac-439, Final Report, Sept. 30, **1951.** 15+p. Appendix 1: **Tabulation of observed data.** 31 p. Appendix 2: **Observational procedures and instrumentation.** 7 p. 24 figs., 9 refs. **DWB**—Bubbles, released at an elevation of 1000 ft above the ground from a captive balloon, were photographed from the ground by a motion picture camera and the results analyzed and compared with TAYLOR'S theory of diffusion, RICHARDSON'S ideas and the modern similarity theories of statistical turbulence. Good agreement was found. The standard deviation of bubble positions were almost proportional to the time (0 to 7 sec). A valuable feature of this paper is the complete tabulation of observed data on 31 pages. *Subject Headings:* **1. Turbulent diffusion 2. Turbulence statistics. I. Contract W28-099ac-439 II. Edinger, James.**—*A.A.*

**4B–248** 551.551:551.511

Charnock, H., **Note on eddy diffusion in the atmosphere between one and two kilometres.** *Royal Meteorological Society, Quarterly Journal*, 77(334):654–658, Oct. **1951.** 3 figs., table, 7 refs., 2 eqs. **MH-BH**—Pairs of smoke puffs released from an aircraft were tracked by camera obscura to give information on eddy diffusion between 1–2 km height. The results are tabulated and compared with predictions by the KOLMOGOROV similarity hypothesis. Good agreement was found in light winds; in stronger winds the results were more scattered. (*Same item as* 3.4–164, April 1952, *MAB.*) *Subject Headings:* **1. Turbulent diffusion 2. Kolmogorov's theory.**—*C.E.P.B.*

**4B–249** 551.551:551.515.3

Combier, Ch., **Étude des mouvements de l'air dans les vents de sable.** [Study on the movement of air in sand storms.] *France. Météorologie Nationale, Mémorial*, No. 35, **1951.** 31 p. 25 figs., 14 refs. **DWB**—A comprehensive report concerning investigations of sand storms and drifting sand made during 1937 and 1938 by the Commission on Atmospheric turbulence of the special Committee on Fluid Mechanics and Meteorology. Former studies are reviewed—both in the countries (Egypt, Sahara, U.S.A., etc.) and at the Ksara Observatory between 1920 and 1935. The nature of eddies which cause and which occur during sand storms is described schematically and the method of investigation by smoke plumes, moving pictures, and two-directional anemometers described and illustrated. The theory of "cycloidal eddies" as an explanation of sandstorms is still considered hypothetical. Descending currents are considered the true cause. Orography plays an important part. *Subject Headings:* **1. Sandstorms 2. Orographic influences 3. Turbulent diffusion 4. Ksara Observatory 5. Syria.**—*M.R.*

**4B–250** 551.551 551.524.1

Crain, C. M. and Gerhardt, John R., **On a new method for the study of atmospheric turbulence near the earth's surface.** *Journal of Meteorology*, 8(5):363–365, Oct. **1951.** 2 figs., 5 refs. **MH-BH**—Authors recorded short-period fluctuations of temperature difference between thermistors 3 ft above ground, simultaneously at distances $S=1$ to 85 inches. The root-mean-square values of the fluctuations °C are fitted by $0.84(1-e^{s/33})$. (*Same item as* 3.4–154, April 1952, *MAB.*) *Subject Headings:* **1. Temperature micro-oscillations 2. Micrometeorological turbulence.**—*C.E.P.B.*

**4B–251** 551.551:551.511

Crutcher, Harold Lee, **Effectiveness of small-scale turbulence in the meridional flux of zonal momentum.** Thesis [M.Sc.]—New York University, June **1951.** 17 p. graphs, tables, refs. Typed manuscript. **DWB**—Using wind records made at two levels on the Brookhaven (N. Y.)

tower on 5 occasions during Oct. and Nov. 1950, the author has calculated the relative contribution of three scales of turbulence ($\geq$6 sec. and $<$1 hour), and their combined contribution to the meridional flux of zonal momentum. The largest value found for meridional flux by turbulence is 1.6 dynes/cm$^2$ compared with 46 dynes/cm$^2$ found by STARR for large scale flux due to turbulence. Thus, the small scale flux is at most 2% of flux by total motion so that the momentum balance of the earth's atmosphere is maintained by eddies of a magnitude such as would be found on synoptic charts. *Subject Headings:* **1. Turbulence scale 2. Atmospheric eddies 3. Zonal momentum.**—*M.R.*

**4B–252** 551.573:551.551

Davies, D. R. and Walters, T. S., **The effect of finite width of area on the rate of evaporation into a turbulent atmosphere.** *Quarterly Journal of Mechanics and Applied Mathematics*, Oxford, 4(4):466–480, Dec. **1951.** 2 figs., 7 refs., 37 eqs. **DWB**—The paper analyzes the effect of width on the rate of evaporation from a plane, rectangular saturated area into a fully turbulent air stream. The calculated evaporation per unit area is proportional to (width)$^{\alpha}$, where $\alpha$ is less than unity, depending only on the turbulence. In adiabatic conditions $\alpha = 0.86$. This was confirmed by wind tunnel experiments. (*Same item as* 3.5–227, May 1952, *MAB.*) *Subject Headings:* **1. Evaporation theory 2. Atmospheric turbulence.**—*C.E.P.B.*

**4B–253** 551.513:551.557

Defant, Friedrich, **Die Änderungen des meridionalen Windprofils durch Kondensationswärme und Turbulenzvorgänge.** [The changes of the meridional wind profile by heat of condensation and by turbulence processes.] *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A*, 4:156–175, **1951.** 8 figs., table, 6 refs., 5 eqs. German summary p. 173–174, English and French p. 156. **DWB**—The wind profile depends on a number of variables involving pressure, temperature, and heat. Author examines the effect of changing individual factors: 1) vertical exchange coefficient; 2) mean rainfall over the earth as a whole (affecting decrease of temperature with height); 3) horizontal meridional exchange coefficient and 4) meridional distribution of precipitation. He calculates resulting meridional temperature and wind profiles. The effects on the development of the jet stream are discussed; the heat of condensation resulting from zonal distribution of precipitation appears to be the dominant factor. This article illustrates the relation between vertical exchange and general circulation. (*Same item as* 3.3–106, March 1952, *MAB.*) *Subject Headings:* **1. Atmospheric circulation 2. Thermodynamics of the atmosphere 3. Jet stream 4. Wind profiles 5. Atmospheric turbulence.**—*C.E.P.B.*

**4B–254** 551.551:551.508.59

De Pasquale, Oreste, **Ricerche sperimentali sulla turbolenza atmosferica.** [Experimental research on atmospheric turbulence.] *Rivista di Meteorologia Aeronautica*, 11(1):10–28, Jan./March **1951.** 10 figs., 7 refs., eqs. Italian, French, English and German summaries p. 10. **MH-BH**—After a brief review of the history of the study of turbulence (REYNOLDS, RAYLEIGH, BÉNARD and PRANDTL), there is a chapter on experiments on the lower layers of the atmosphere by means of pilot balloons and the limitations of this method; one on the use of captive balloons for the same purpose; then a method which avoids the limitations of the other two methods, involving the use of a new instrument called a turbograph and, finally, its adaptation to long range transmission by a special transmitter (turbi-sonde). Theory is developed in each case and equipment, records, etc. are illustrated by photographs and schematic diagrams. (*Same item as* 3.5–216, May 1952, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Turbulence measurement 3. Turbographs 4. Anemographs 5. History of meteorology.**—*M.R.*

**4B–255** 551.510.42:551.551

Eisenbud, Merril and Harris, W. B., **Meteorological technics in air pollution surveys.** *Archives of Industrial Hygiene and Occupational Medicine*, Chicago, 3:90–97, Jan. **1951.** 4 figs., 2 tables, 3 refs., 5 eqs. Abstracted from reprint. **DWB**—Theoretical studies on wind speed and turbulent diffusion, combined with actual tests made of concentration of gases at different distances downwind from a continuous point source or stack, have made it possible to determine dosages likely to occur under various weather conditions near sources of radioactive waste gases. SUTTON's equation is briefly explained and used to construct a nomogram for calculating concentrations up to 10 km from stacks 10, 25 and 50 m high, and tests conducted over a period of six days to see if the formula held good for two types of material (A and B) emitted from a stack. Agreement was found good for B but not for A. Other tests showed good agreement. (*Same item as* 3.5–117, May 1952, *MAB.*) *Subject Headings:* **1. Atmospheric pollution 2. Turbulent diffusion of gases 3. Industrial hygiene.** —*M.R.*

**4B–256** 551.551

Fleagle, Robert G. and others, **Atmospheric turbulence study.** Washington. (State) Univ. Dept. of Meteorology and Climatology, Contract AT(45-1)-236, Occasional Report No. 1, April

1951. 26 p. figs., refs., eqs. **DWB**—The report summarizes the results to April 30, 1951 of an investigation of relationships between meteorological quantities and the rate of diffusion of matter in the lower atmosphere. The approach chosen was a study of eddy conductivity as related to wind speed, vertical temperature lapse rate, and the nature and distribution of obstacles. Results of a photographic study of atmospheric turbulence and of studies of variation of wind with height and vertical temperature distribution in turbid air are included. Plans for additional studies are outlined. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulent diffusion. I. Contract AT(45-1)-236 II. Washington (State) Univ. III. Badgley, Franklin I. IV. Davis, Paul A. V. Fuquay, James VI. Hubley, Richard C. VII. Islitzer, Norman VIII. Scuderi, John.**

**4B–257** 551.551

Frankenberger, Ernst, **Über Austauschmessungen.** [On exchange measurements.] *Zeitschrift für Meteorologie*, 5(5–6):171–172, May–June **1951.** 2 figs., 3 refs., eqs. **MH-BH**—The potential temperature gradient calculated by theory is less than the observed gradient above 10 m on a July day, while the wind profiles agree. This is due to convection. Author gives a sketch of the part played by turbulent and convective heat exchange at different heights and different wind velocities. (*Same item as* 2.10–115, Oct. 1951, *MAB.*) *Subject Headings:* **1. Turbulent transfer of heat 2. Austausch 3. Wind profiles.**—*C.E.P.B.*

**4B–258** 551.510.535:551.551

Gallet, Roger, **Sur la nature de la couche E sporadique et la turbulence de la haute atmosphère.** [On the nature of the sporadic E layer and turbulence of the upper atmosphere.] *Académie des Sciences, Paris, Comptes Rendus*, 233(25):1649–1650, Dec. 19, **1951.** ref., eq. **DWB**—An attempt to formulate the relation between the optical turbidity, the changes in molecular density (turbulence), and the electronic density in the high atmosphere as a method of explaining and measuring the fluctuations in the ionospheric E layer. *Subject Headings:* **1. Sporadic E layer 2. Ionospheric turbulence 3. Electron density.**—*M.R.*

**4B–259** 551.551

†Halstead, Maurice H., **The relationship between wind structure and turbulence near the ground.** Johns Hopkins University. Laboratory of Climatology, Seabrook, New Jersey, Contract W28-099-ac-378, Suppl. to Interim Report No. 14, June, **1951.** 49 p., 21 figs., 11 tables, 56 eqs., bibliog. p. 46–48, append. **DWB**—The author makes the assumption that the shearing stress and the exchange coefficient for momentum are linearly dependent upon height. Using the fundamental equation of W. SCHMIDT he devises a differential equation, the integral of which can be presented in the form

$$u = p_1 \ln(p_2 z + l) + p_3 z$$

$p_1$, $p_2$, $p_3$ = constants. Formulas for the dependence of these constants upon shearing stress and upon exchange coefficient and their variation with the height, ($z$) and wind velocity ($u$) are given. Almost each observed wind profile can be represented by this formula with great accuracy but the agreement with observations cannot be considered as a proof of the theory in this case. The diurnal variation of the basic constants is given. The shearing stress at the ground is very low at night and increases sharply during the daytime. The vertical increase of the exchange coefficient has a similar diurnal course. The shearing stress increases with height during the night and decreases during the daytime. The author suggests the application of the same mathematical method with different exchange coefficients to the calculation of vertical transfer of moisture and heat. *Subject Headings:* **1. Turbulence theory 2. Wind structure 3. Seabrook, N. J. I. Johns Hopkins University, Laboratory of Climatology II. Contract W28-099-ac-378.**—*A.A.*

**4B–260** 551.551 551.554

Haurwitz, Bernhard and Stern, Melvin E., **The effect of vertical wind shear on turbulent transfer.** Woods Hole Oceanographic Institution, Contract N6onr-27702(NR-082-021), Technical Report No. 11, July **1951.** 16 p. 5 figs., 5 refs., 22 eqs. **DWB**—The turbulent transfer of heat, which is similar to that of moisture or mass, is considered for an atmosphere where the wind increases with height, and for one with a constant speed throughout the layer. The equations are solved and curves drawn for specific cases, showing that the difference in most cases is not significant if a mean wind is used for some representative height or if increasing winds are considered. The best height to choose is not that of the arithmetic mean but that of some lower layer where the effects of heat transfer are strongest. *Subject Headings:* **1. Turbulent transfer of heat 2. Wind shear. I. Woods Hole Oceanographic Institution II. Contract N6onr-27702(NR-082-021).**—*M.R.*

**4B–261** 551.551

*Hewson, Edgar W., Gill, Gerald C., Cramer, Harrison E. and Record, Frank A., **Research on turbulence and diffusion of particulate matter in the lower layers of the atmosphere.** Massachusetts

Institute of Technology, Round Hill Field Station, Contract AF 28(099)-7, Progress Reports Nos. 1–11, Feb. 10, 1949–Aug. 10, **1951.** 11 pieces. tables, figs., refs., eqs. Final Report, Nov. 30, **1951.** 80 p. figs., tables, refs., eqs. **DWB**—Progress reports Nos. 1–11 include descriptions of the development and use of new instruments (gustometer, smoke densometer) and details of progress in various subprojects. Considerable data are tabulated in reports Nos. 8–11. The final report is a sizeable summary of research accomplished during the project including a statement of research and methods employed and lengthy reviews of the following five topics: 1) General instrumentation; 2) The structure of turbulent flow; 3) Turbulent flow and diffusion near the earth's surface; 4) The development of instrumentation for the determination of eddy coefficients and 5) Symposium on atmospheric turbulence in the boundary layer. *Subject Headings:* **1. Turbulent diffusion 2. Turbulence theory 3. Boundary layer 4. Turbulence measurement. I. Massachusetts Institute of Technology II. Contract AF 28(099)-7.**—*M.P.K.*

**4B–262** 551.551

Inoue, Ei-ichi, **On the turbulent diffusion in the atmosphere (II).** *Meteorological Society of Japan, Journal, 2nd Ser.*, 29(7):246–253, July **1951.** fig., table, 5 refs., 17 eqs. In English, Japanese summary p. 253. **DWB**—The author applies theoretical results obtained in his first paper to actual conditions in the atmosphere; namely, horizontal diffusion and vertical diffusion of smoke. Horizontally the processes are considered isotropic, but vertically they are obviously not. Measurements were made during Aug. 1948 by the author, using puffs of smoke from fireworks photographed at 1 sec intervals. Assuming 90% of the smoke to be contained in the area which could be traced from the photographs, calculations of various turbulence parameters are made for heights of 3, 5 and 6 m and compared with values obtained by RICHARDSON for $Z = 2$ m. Results show that the length of the highest turbulence element is about 10% of its height, and is restricted by the distance from the earth's surface. The boundary between isotropic and nonisotropic turbulence is a function of heights above ground. Smoke from a moving locomotive is also considered. (For Pt. I *see item* 2.7–114, July 1951. *MAB.*) (*Same item as* 3.8–124, Aug. 1952, *MAB.*) *Subject Heading:* **1. Turbulent diffusion.**—*M.R.*

**4B–263** 551.551:533.6

Kampé de Fériet, J., **Averaging processes and Reynolds equations in atmospheric turbulence.** *Journal of Meteorology*, 8(5):358–361, Oct. **1951.** 20 eqs., 9 refs. **MH-BH**—Four axioms assumed by REYNOLDS in deriving his equations for turbulent flow are discussed and it is shown that they can probably be satisfied by averaging only eddies of a given diameter (imposed by the instrument used in measurement), smaller eddies remaining unknown. (*Same item as* 3.4–168, April 1952, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Atmospheric turbulence.**—*C.E.P.B.*

**4B–264** 551.511:551.551:531.3

Kampé de Fériet, J. (*Univ. of Lille, France*), **Generalized harmonic analysis and some boundary value problems.** *Maryland. University. Institute for Fluid Dynamics and Applied Mathematics. Lecture Series*, No. 12, **1951/1952.** 103 p. 17 refs., eqs. **DWB**—In a theoretical course including 278 equations, the lecturer offers an elaborate analysis of harmonics with special reference to the case of turbulence. Formulas and theories of many authorities in the field are quoted and explained. *Subject Headings:* **1. Harmonic analysis 2. Boundary layer 3. Lecture series. I. Pai, S. I.** (*ed.*). —*G.T.*

**4B–265** 551.508.29:551.524.4:551.551

Kassander, A. Richard, Jr., **Investigations of turbulent temperature fluctuations in the lower atmosphere.** Iowa, State College of Agriculture and Mechanical Arts, Physics Dept., Contract AF 19(122)-440, Report No. 2, July 15, **1951.** 11 p. 5 figs., 3 refs. **DWB**—Experiments were conducted on the lag time and heat dissipation of thermistors in dependence on wind speed and relation between measurement conditions in the laboratory and in the atmosphere. The broad purpose of these investigations is to develop a thermometer with minimum time lag and radiational error; the development of recording devices for these measurements and of mechanical methods of data analysis, and finally, the organization of a rational field program of investigations of sensible heat content of micrometeorological layer of the atmosphere. *Subject Headings:* **1. Turbulent temperature fluctuations 2. Thermistors 3. Thermometer lag 4. Micrometeorological turbulence. I. Stewart, R. M., Jr. II. Contract AF 19(122)-440 III. Iowa. State College of Agriculture and Mechanical Arts. Physics Dept.**—*M.R.*

**4B–266** 551.511(02)

Koschmieder, Harald, **Dynamische Meteorologie.** [Dynamic meteorology.] 3rd enl. ed. Leipzig, Geest & Portig, **1951.** 404 p. diagrs., graphs, tables, bibliog. **DLC**—The section on "Austausch" explains clearly why the internal friction or viscosity in natural conditions, as deter-

mined by micrometeorological wind profiles, is 1000 to 1,000,000 times as great as the values obtained n the laboratory. Beginning with KÖPPEN's (1879) work in the frictional influences over the sea, nd HANN and KÖPPEN's theory that the basis for turbulence lay in the temperature differences, his text goes on to present the basic equations of the *austausch* theory according to PRANDTL, SCHMIDT and TAYLOR, and the vertical transport of heat and momentum with horizontal flow, and application to the diurnal temperature wave. (*Same item as* 3.7–6, July 1952, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Turbulent exchange 3. Textbooks.**—*M.R.*

**4B–267** 551.511:551.551

Lettau, Heinz, **Diffusion in the upper atmosphere.** (In: **Compendium of meteorology.** Boston, American Meteorological Society, **1951.** p. 320–333. 4 figs., 6 tables, 38 refs. 99 eqs.) **MH-BH, DWB**—Using the basic equation of CHAPMAN and COWLING for molecular diffusion where the thermal diffusion velocity can be disregarded, and equation for eddy diffusion, the author discusses the resulting atmospheric diffusion from different points of view. A medium of an $N_2$ atmosphere is assumed. The general solutions for diffusion in the vertical under steady conditions are given. The border cases are the states of maximum mixture and of maximum separation or the Dalton atmosphere. The general case of partial separation is discussed. The effects of sources and sinks must be considered, for example, for the diffusion of helium, carbon dioxide, ozone and atomic oxygen. Results are obtained for the diffusion of dust. More complicated is the solution for the vertical diffusion under unsteady conditions. The time required for establishing equilibrium can be calculated. A computation is carried out for argon. As an example for three-dimensional diffusion the meridional and annual variations of total ozone are examined. (*Same item as* 3.7–7, July 1952, *MAB.*) *Subject Headings:* **1. Molecular diffusion 2. Turbulent diffusion 3. Upper atmosphere 4. Turbulence theory.**—*A.A.*

**4B–268** 551.511:551.551

Lettau, Heinz, **Theory of surface-temperature and heat-transfer oscillations near a level ground surface.** *American Geophysical Union, Transactions,* 32(2):189–200, April **1951.** 3 figs., 5 tables, 9 refs., 55 eqs. **DWB**—The heat-budget equation of the earth's surface is discussed analytically under the assumption that the radiational energy available at the ground is a harmonic time function, evaporation is constant, and heat conduction is molecular in the soil and turbulent in the atmospheric surface layer. A theoretical model of surface temperature oscillations is derived which gives the amplitudes and phase lags of both the diurnal and annual courses in terms of external conditions and the physical properties of the soil and atmosphere. Numerical verification of the theoretical results in comparison with observed findings seems to indicate that certain characteristics of the various microclimates can be explained on a physico-mathematical basis. *Subject Headings:* **1. Turbulent transfer of heat 2. Diurnal temperature variations 3. Annual temperature variations.**—*Author's abstract.*

**4B–269** 551.511:551.551:551.558.1

McCormick, Robert Amos, **The vertical flux of momentum by small eddies.** Thesis [M.Sc.]—New York University, April **1951.** 17 p. 2 figs., 4 tables, 9 refs., 8 eqs. Typescript. **DWB**—Study is based on simultaneous observations of horizontal and vertical velocities made at 355 ft level at Brookhaven National Laboratories by means of aerovane and bivane recording instruments. Eddies of periods $>10$ sec and $<1$ hour duration were analyzed to determine relative contribution of 3 sizes of these eddies to the total momentum flux, for the purpose of aiding design of instruments for measuring Reynolds stresses. Conclusion is that the "middle size" or 8-minute class of eddies, with a vertical wave length of about 1000 ft, was the most important in transport of momentum. These are presumably the eddies that are associated with cumulus cloud development. *Subject Headings:* **1. Turbulent transfer of momentum 2. Turbulence measurement 3. Brookhaven, N. Y.**—*M.R.*

**4B–270** 551.551

Matschinski, Matthias, **Sur la structure du vent et sur les phénomènes secondaires (différents "wind marks" sur le sable et sur la neige) qu'elle provoque.** [On wind structure and on the secondary phenomena (various wind marks on sand and snow) which it produces.] *Académie des Sciences, Paris, Comptes Rendus,* 233(10):580–582, Sept. 3, **1951.** eqs. **DWB**—The equations of motion are applied to the case of the effect of wind moving over an obstacle and the production of wind traces or ripples in sand and snow. It is shown that the distance between crests corresponds to the distance between elements of turbulence, or in other words, is of the order of magnitude of the cells or vortices. (*Same item as* 3.5–218, May 1952, *MAB.*) *Subject Headings:* **1. Wind structure 2. Turbulence in clouds 3. Turbulence effects 4. Wind traces 5. Equations of motion.**—*M.R.*

**4B–271** 551.541:551.551

Matthews, L. S., **Pressure and wind oscillations at Khartoum.** *Weather*, 6(6):185, June **1951.** 2 tables. **DWB**—Sept. 30, 1950, 3–4½ h., a series of damped waves was recorded, period 15 minutes, initial amplitude 0.8 mb. and 12 m.p.h. Cause obscure but "pulses" of wind corresponded with winds at 500–1500 ft. (*Same item as* 2.10–112, Oct. 1951, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Pressure oscillations 3. Khartoum, Egypt.**—*C.E.P.B.*

**4B–272** 551.508.53/4:551.51:551.556.4

Mazzarella, Daniel A., **An all-weather, remote-recording bivane.** *U. S. Atomic Energy Commission, AECU*-1243, Aug. 8, **1951.** 29 p. 11 figs., table, 15 refs. Also in: *American Meteorological Society, Bulletin*, 33(2):60–66, Feb. **1952. DWB**—Designed by author and P. H. Lowry at Brookhaven, N. Y., for recording long period gusts and their effect on diffusion or dispersion of stack effluents. The instrument was intended for use on the higher levels of the 420 ft tower to record eddies of a period of about 5 minutes (which bring smoke to the ground). Construction, wind tunnel tests, field tests (since Jan. 1950) and by comparisons during more than a year of operation are described. Corrosion was almost eliminated but rain, snow, ice and high winds such as occurred during the Nov. 27, 1950 storm interrupted continuous records or made them inaccurate. (*Same item as* 3.5–66, May 1952, *MAB.*) *Subject Headings:* **1. Wind recorders 2. Turbulence measurement 3. Turbulent diffusion 4. Stack effluents. I. Brookhaven National Laboratories, N. Y. II. Lowry, P. H.**—*M.R.*

**4B–273** 551.551

Milin, V. B., **K voprosu opredeleniia koefitsienta turbulentnogo obmena v prizemnom sloe atmosfery.** [On the determination of the coefficient of turbulent exchange in the layer of the air near the ground.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Informatsionnyĭ Sbornik*, 1:28–36, **1951.** figs., 2 tables, 5 refs. **DLC**—The use of radioactive measurements to determine the coefficient of turbulent exchange is suggested. The basic differential equation is:

$$\frac{\partial S}{\partial t} = A\frac{\partial^2 S}{\partial h^2} + \frac{\partial A}{\partial h}\frac{\partial S}{\partial h} = \lambda S$$

$S$ = concentration of the emanation in the air; $t$ = time; $h$ = height above the ground; $\lambda$ = decay constant of the emanation; $A = f(h)$—coefficient of turbulent exchange. The author elaborated a method for the determination of $A$ knowing $S$ for the air in the soil and in the atmosphere and knowing the diffusion coefficient of the emanation in the soil. Results of measurements and calculations show a sharply expressed diurnal course of the exchange coefficient. *Subject Headings:* **1. Exchange coefficient 2. Radioactive diffusion 3. Diurnal exchange variations.**—*A.A.*

**4B–274** 551.551

Monin, A. S., **Turbulentnyĭ rezhim v prizemnom sloe vozdukha.** [Turbulent regime in the layer of air near the ground.] *U.S.S.R. Glavnoe Upravlenie Gidrometeorologicheskoĭ Sluzhby, Informatsionnyĭ Sbornik*, 1:13–27, **1951.** 2 figs., 12 refs., 33 eqs. **DLC**—A concentrated review of the general theory of turbulence, as it was developed or improved by Russian scientists, especially Kolmogorov. Simplified solutions are given for the layer near the ground. The equations of Prandtl, Kármán and other scientists are shown as single cases of the general theory. Stable and labile stratification is discussed. The assumptions of Budyko, who published a series of papers from 1946 to 1948 on this topic are criticized and the scheme of Obukhov (papers from 1942 to 1949) is commended. *Subject Headings:* **1. Turbulence theory 2. Atmospheric turbulence. I. Budyko, M. I. II. Obukhov, A. M.**—*A.A.*

**4B–275** 551.551

Neumann, Gerhard, **Gibt es eine "kritische Windgeschwindigkeit" für die Grenzfläche Wasser-Luft?** [Is there a "critical wind velocity" for the boundary surface water-air?] *Deutsche Hydrographische Zeitschrift*, 4(1–2):6–13, **1951.** 3 figs., 2 tables, 11 refs. German, English and French summaries p. 6–7. **DWB**—American investigators assume that with wind velocities under 6 m/s a water surface is aerodynamically smooth, above that rough, causing a discontinuity in the wind profile. This is not shown by observations over inland waters, where coefficient of friction is given by $9 \times 10^{-3}/\sqrt{v}$. Author relates discrepancy to the breakdown of the logarithmic law very near the surface because of different vertical variations above wave crests and troughs, so that extrapolation leads to error. He derives new reduction factors for a wind of 3 m/sec at 100 cm above wave crests. The effects of corrections using different assumptions all point to a friction greater than that calculated directly from the observations. He infers that the supposed discontinuity at 6–7 m/s does not exist. (*Same item as* 3.4–169, April 1952, *MAB.*) *Subject Headings:* **1. Frictional effects 2. Wind profiles 3. Ocean-atmosphere interaction.**—*C.E.P.B.*

**4B–276** 551.551

Ogura, Y., **The theory of turbulent diffusion in the atmosphere.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 30(1):23–28, Jan. **1951.** 3 figs., 20 eqs., 4 refs. **MH-BH**—The problem is discussed from the statistical point of view. The author gives a formula to determine the diffusion width directly. The diffusion of large balloons is examined. *Subject Headings:* **1. Statistical theory of turbulence 2. Turbulent diffusion.**—*A.A.*

**4B–277** 551.573 · 551.511

Osborn, R. R., **Computing evaporation using turbulent transport equations.** (In: Johns Hopkins University. Laboratory of Climatology, Seabrook, N. J., **Micrometeorology of the surface layer of the atmosphere.** Contract W28-099-ac-378, Interim Report 16:7–9, Dec. 31, **1951.** 2 refs., eqs.) **DWB**—The author uses the turbulent transport equation developed by HALSTEAD (*see* B–260 above). For the solution of this equation the absolute humidity of the air must be known at the evaporating surface and at two additional levels. The results obtained from the measured moisture profiles are checked by independent methods. Good agreement was found. *Subject Headings:* **1. Evaporation 2. Turbulent transfer of moisture.**—*A.A.*

**4B–278** 551.524.1:551.551

Panofsky, Hans A., **A preliminary analysis of the vertical heat flux at five meters over water.** Woods Hole Oceanographic Institution, Marine Meteorology, Contract N6onr-27702, Project NR-082,021, Technical Report No. 13, Sept. **1951.** 15 p. 5 tables, 7 refs., 5 eqs. **DWB**—A crude spectral analysis of heat flux has been carried out on the basis of observations of vertical velocity and temperature at 5 m elevation, which were available for a number of periods and each of which lasted 4 to 5 minutes. The following tentative conclusions were obtained: 1) "The sign and magnitude of the heat flux measured at Woods Hole at 5 m elevation are reliable under unstable conditions only." 2) "Up to 25% of the kinetic energy under stable conditions and about 15% under unstable conditions lies at a frequency too high to be measured with existing instruments." 3) Maximum kinetic energy occurs at higher frequencies than maximum kinetic flux." (*Same item as* 3.4–155, April 1952, *MAB.*) *Subject Headings:* **1. Turbulent transfer of heat 2. Temperature micro-oscillations. I. Woods Hole Oceanographic Institution II. Contract N6onr-27702, Project NR-082-021.**—*I.L.D.*

**4B–279** 551.511 551.551

Panofsky, Hans A. and Crutcher, Harold L., **Horizontal momentum flux due to small-scale turbulence.** *Journal of Meteorology*, 8(6):420–421, Dec. **1951.** 2 figs., 3 refs. **MH-BH**—Deviations of 10-sec average N and E components at a height of 109 m at Brookhaven, New York, from trend smoothed over an hour, were horizontally isotropic and gave values of meridional flux of zonal momentum negligible compared with large scale flux. (*Same item as* 3.6–80, June 1952, *MAB.*) *Subject Headings:* **1. Turbulence statistics 2. Zonal momentum.**—*C.E.P.B.*

**4B–280** 551.551

*Panofsky, Hans A. and Singer, I. A., **AEC-Air Pollutions Project, Meteorological phase.** New York University, Contract AF (30-1)-965, Annual Progress Report, June 30, **1951.** 67 p. tables, graphs, eqs., bibliog. On cover title: United States Atomic Energy Commission, Technical Information Service, Oak Ridge, Tennessee. **DWB**—Studies were made to determine whether a wind tunnel could be used to simulate atmospheric conditions for turbulence studies. Measurements of eddy heat and momentum exchange coefficients were made by various methods and compared with each other. Properties of the turbulence spectrum, changes in character of turbulence, and variation of wind with height up to 125 m (400 ft) were examined from data obtained at Brookhaven, Long Island. Conclusion is that best method of determining exchange coefficients is by direct measurement of Reynolds flux. The pilot balloon and the diurnal temperature variation method are not as satisfactory. Vertical heat and momentum flux is produced by Fourier components of turbulence with period of few minutes, whereas kinetic energy is accounted for by periods four times as long. Difference between wind tunnel and atmosphere lies mainly in smaller roughness of tunnel, so that they might be comparable if Richardson number were made equal at equivalent distances $z/z_0$ in tunnel $= z/z_0$ in atmosphere). *Subject Headings:* **1. Laboratory turbulence models 2. Turbulence theory 3. Turbulent exchange. I. U. S. Atomic Energy Commission II. New York University.**—*M.R.*

**4B–281** 551.551:551.554

Poppendiek, Heinz F. (*Univ. of California, Los Angeles*), **Gustiness profiles in the lower layers of the atmosphere.** *Meteorological Monographs*, Boston, 1(4):36–38, Nov. **1951.** 4 figs., 5 refs. **MH-BH**—Two sets of experimental gustiness profiles in the lower layers of the atmosphere under a range of stability conditions are presented. One set was obtained in the lower 200 ft over a desert

in Arizona and the other set was obtained in the lower 2000 ft over Los Angeles, California. These measurements were made with the aid of British bivanes and by observing diffusion rates of smoke plumes. Some interpretations of the diurnal variations of these gustiness profiles are given. *Subject Headings:* **1. Gustiness 2. Turbulent diffusion.**—*Author's abstract.*

**4B–282** 551.551 551.556.2

Rider, N. E., **The effect of a hedge on the flow of air.** *Great Britain. Meteorological Research Committee, M.R.P.* 602, S.C. III/19, Jan. 3, **1951.** 5 p. graphs, tables, photo. Also in: *Royal Meteorological Society, Quarterly Journal,* 78(335):97–101, Jan. **1952. DWB**—Report on experiment for determining the effect of a hedge on the horizontal wind speed. Feature claimed to be most striking is a measurement which appears to contradict generally accepted opinion concerning influence of objects at a certain distance. Effect on turbulent exchange is considered. *Subject Headings:* **1. Micro turbulence 2. Windbreaks 3. Wind profiles 4. Turbulent exchange.**—*M.R.*

**4B–283** 551.508.53/4:551.551

Rosenbrock, H. H. and Tagg, J. R. (*Br. Elec. & Allied Ind. Res. Assoc.*), **Wind- and gust-measuring instruments developed for a wind-power survey.** *Electrical Research Association, Technical Report* C/T104, **1951.** 10 p. 15 figs., refs. Price 9/–. **DWB**—Description of two recorders and an anemometer for measuring gusts, which were developed in Great Britain and which operate unattended for a week. Modified forms of the instruments measure horizontal and vertical components of the wind. *Subject Headings:* **1. Gustiness measurement 2. Anemometers 3. Great Britain.**—*From author's summary.*

**4B–284** 551.508.53/4:551.551

Rosenbrock, H. H., **The design and development of three new types of gust anemometer.** *Electrical Research Association, Leatherhead, Surrey, England, Technical Report,* C/T106, **1951.** 37 p. 44 figs., 9 tables, eqs., 23 refs. Price, 24/–. **DWB**—Drawbacks of existing anemometers summarized. The new types which use "small perforated spheres of aluminum as the detecting element and mechano-electronic transducers to give an electrical indication measure respectively: a) the horizontal component of the wind velocity, b) the horizontal component at right angles to the mean wind direction and c) the vertical component of the wind velocity." *Subject Headings:* **1. Gustiness measurement 2. Anemometers.**—*M.P.K.*

**4B–285** 551.510.42:551.588.7

Rouse, Hunter, **Air-tunnel studies of diffusion in urban areas.** *Meteorological Monographs,* Boston, 1(4):39–41, Nov. **1951.** 3 figs. **MH-BH**—Scale models of groups of houses in a wind tunnel give a true picture of large-scale turbulent diffusion. This was applied to studies of diffusion of $SO_2$ in urban districts from a point source. The relative concentration contours are plotted and it is suggested that the technique be applied to smoke diffusion studies. *Subject Headings:* **1. Turbulent diffusion of gases 2. Urban influences 3. Wind tunnel experiments.**—*C.E.P.B.*

**4B–286** 533.16(02):551.551

†Schlichting, Hermann, **Grenzschicht-Theorie.** [Boundary layer theory.] Karlsruhe, G. Braun, **1951.** 483 p. figs., tables, bibliog. p. 475–477. **DLC**—This important text contains numerous applications to boundary layer problems of the surface layers of the atmosphere. (For a fuller abstract *see item* 4.1–8, Jan. 1953, *MAB.*) *Subject Headings:* **1. Turbulence theory 2. Boundary layer theory 3. Textbooks.**—*M.R.*

**4B–287** 551.551

Sheppard, P. A., **Atmospheric turbulence.** *Weather,* 6(2):42–49, Feb. **1951.** 4 figs., 8 refs. **DWB**—A good, popular introduction. On every scale of air motion from global circulation downwards, a spectrum of motions is superposed, which ends in molecular dissipation. Turbulence is defined as comprising all superposed motions of smaller scale than that under consideration. The transfer of momentum, heat and moisture by turbulence is discussed; it is partly but not always proportional to the gradient of the quantity. Present trends in research are illustrated by vertical and horizontal diffusion and boundary layer turbulence. (*Same item as* 2.6–81, June 1951, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Turbulent exchange.**—*C.E.P.B.*

**4B–288** 551.584:551.524.4:551.558.1

Skvortsov, A. A., **O teplovoĭ konvektsii i obmene v prizemnom sloe atmosfery.** [Heat convection and exchange in the surface layer of the atmosphere.] *Akademiia Nauk, SSSR, Izvestiia, Ser. Geofiz.,* No. 6:60–80. Nov.–Dec. **1951.** 6 figs., 9 tables, 4 eqs., 4 refs. **DLC**—The convective heat exchange on heated surfaces was investigated experimentally by measuring with thermocouples the continuous oscillations in air temperature in the lowest four meters of the atmosphere adjacent

o the ground. Differences in duration of oscillations and of amplitudes of temperature at various evels confirm a previously established hypothesis that convective heat exchange proceeds by the ormation of convective layers formed by ascending and descending air currents which die out in he course of transfer of heat from the ascending air and from mass of heated air to cooler descending urrents and which are reformed by the periodic destruction and reestablishment of layers. The existence of three such convective layers is established and their properties are described qualitatively. This hypothesis is used to explain the behavior of smoke screens. The theory of convective heat exchange by means of convective layers is found to agree with the theory of local turbulence of KOLMOGOROV. A new method of calculating evaporation from natural surfaces is developed. (*Same item as* 3.7–184, July 1952, *MAB.*) *Subject Headings:* **1. Convective heat exchange 2. Turbulent exchange 3. Evaporation.**—*I.L.D.*

**4B–289** 551.509.58:551.584

Smith, Maynard E., **The forecasting of micrometeorological variables.** *Meteorological Monographs*, Boston, 1(4):50–55, Nov. **1951.** 2 figs., 2 tables, 5 refs. **MH-BH**—Among all the parameters which influence stack gas dispersion from Nuclear Reactors, the most important to forecast are direction, speed and turbulent character of air flow up to 400 ft height for average periods of at least one hour. The synoptic pattern (sea-level pressure and geostrophic winds estimated therefrom) and the local wind circulation (land-sea breezes) are predicted for given time of day, since the diurnal effect is reversed at heights >200 ft over heights <200 ft, and given lapse rates. A classification of turbulence or gustiness was developed from type of traces found on gust recorders. Forecasts are made in terms of this scale and other factors (cloud, wind, snow cover, etc.) predicted on the basis of empirical relationships. Forecasts are finally interpreted in terms of operations by use of templates, etc. Verification is also in terms of operations. *Subject Headings:* **1. Turbulence forecasting 2. Objective forecasting 3. Turbulent diffusion of gases 4. Brookhaven, N. Y.**—*M.R.*

**4B–290** 551.551

Stewart, H. J. and MacCready, P. B., Jr., **Progress report on investigation of atmospheric turbulence.** Pasadena, California Institute of Technology, April **1951.** 31 p. 28 figs. **DWB**—Measurements of turbulent fluctuation up to 300 m from ground. Results given in graphs. Photographs of equipment and instrumentation. *Subject Headings:* **1. Turbulence in the frictional layer 2. Turbulence measurement.**—*M.R.*

**4B–291** 551.551 551.554

Takeda, K., **On the atmospheric turbulence. 3rd paper. On the generalized logarithmic formula of wind velocity distribution.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 29(9):287–297, Sept. **1951.** 3 figs., 12 refs., 33 eqs. In Japanese, English summary p. 295–297. **MH-BH**—From experimental results by PASQUILL and BEST and a formula by DEACON author develops the expression:

$$d(u/U) = \frac{a}{U} z^{1-\beta}$$

where $u$ = wind velocity at height $z$, $U$ = velocity at $z = 1$ and $\beta$ has extreme values of 0.79 for stable air and 1.13 for unstable air. For neutral stability he recommends a logarithmic formula including a roughness term. *Subject Headings:* **1. Wind profiles 2. Atmospheric turbulence.**—*C.E.P.B.*

**4B–292** 551.551:551.507.321

van der Ham, C. J., **Interessante resultaten van enkele kinderballonwedstrijen.** [Interesting results of some toy balloon flights.] *Hemel en Dampkring*, 49(6):112–113, **1951. DLC**—An analysis of two releases of balloons in clusters, 950 balloons at Rijswijk, Holland on June 17, 1950 of which 346 were recovered) and another release from Dordrecht on Sept. 30, 1950. The distribution of recoveries is shown in a chart in connection with the topography and flow at 850 mb. (*Same item as* 2.11–114, Nov. 1951, *MAB.*) *Subject Headings:* **1. Balloon dispersal 2. Turbulent diffusion 3. Topographic effects 4. Netherlands.**—*M.R.*

**4B–293** 551.524.4:551.554:551.551:536.2

Vehrencamp, John E., **An experimental investigation of heat and momentum transfer at a smooth air-earth interface.** California. University, Dept. of Engineering, Contract N6-ONR-275, T.O. VI, Contract NR-082-036, [Report] May **1951.** 53 leaves. 30 figs., 22 refs., 19 eqs. **DWB**—Calculations of heat and momentum transfer made from micrometeorological data obtained over the smooth, dry bed of El Mirage Lake, Calif., during the week of June 5–12, 1950. Several new instruments were tried and further improvements in instrumental construction and technique recommended. Vertical convective heat transfer rates were obtained from measurements made on the earth's surface with a radiometer and in the ground with a heat meter. Shear stresses were

measured with a shear meter. Results compared with those of PASQUILL, POPPENDIEK and SHEPPARD over grass, disced and concrete surfaces, respectively. Equipment and results are well presented. (*Same item as* 2.10–105, Oct. 1951, *MAB.*) *Subject Headings:* **1. Turbulent diffusion 2. Micrometeorological profiles 3. Shear stress 4. El Mirage Lake, Calif. I. California. University. Dept. of Engineering II. Contract N6-onr-275.**—*M.R.*

**4B–294** 551.511:551.551

Yih, Chia-shun, **Atmospheric diffusion from a point source.** Colorado, Agricultural and Mechanical College, Civil Engineering Dept., Contract N9onr-82401, Report No. 4, August **1951.** 9 p. 8 refs., 35 equations. Also in: *American Geophysical Union, Transactions,* 33(3):356–360, June **1952. DLC**—The differential equation of diffusion when the wind velocity and the vertical lateral diffusivities are power functions of height is

$$y^m \frac{\partial c}{\partial x} = D_1 \frac{\partial}{\partial y}\left(y^n \frac{\partial c}{\partial y}\right) + D_2 y^k \frac{\partial^2 c}{\partial z^2}$$

where $x$, $y$, and $z$ are measured respectively in the down wind, vertical and cross-wind directions and $D_1$ and $D_2$ are physical constants to be defined in the text. Exact solution of this equation for the case of a point source and for $m = k$ is presented in this paper. In the systematic search for this solution, dimensional analysis has been utilized to the optimum advantage. *Subject Headings:* **1. Turbulent diffusion 2. Point sources. I. Colorado. Agricultural and Mechanical College. Civil Engineering Dept. II. Contract N9onr-82401.**—*Author's abstract.*

## 1952

**4B–295** 551.551 797.5

Banerji, Sudhansu Kuman (*Coll. of Eng. & Tech., Bengal*), **Gliding and soaring flights.** *Aeronautical Society of India, New Delhi, Journal,* 4(2):33–49, May **1952.** 13 figs., eqs., refs. **DWB**—In a review of the mechanism of gliding and soaring, attention is paid to wind structure, gustiness, föhn waves, thermals and other low level meteorological factors influential in such flight. *Subject Headings:* **1. Gustiness 2. Gliding 3. Wind structure.**—*M.P.K.*

**4B–296** 551.511

Budyko, M. I., Drozdov, O. A., L'vovich, M. I., Pogosian, Kh. P., Sapozhnikova, S. A. and IUdin, M. I., **Izmenenie klimata v sviazi s planom preobrazovaniia prirody zasushlivykh raĭnonov SSSR.** [Changing the climate in connection with the plan for transforming nature in the arid regions of the U.S.S.R.] Leningrad, Gidromet. Izdat., **1952.** 206 p. 50 figs., 34 tables, 143 refs. **DLC**—Chapter III of seven is on changing the turbulent exchange by altering the degree of turbulence or vertical motion through the use of forests and shelter belts. *Subject Headings:* **1. Turbulent exchange 2. Shelter belts 3. Climatic amelioration 4. U.S.S.R.**—*M.R.*

**4B–297** 551.551 551.5:894

Bunker, Andrew F., **Diffusion, entrainment, and frictional drag associated with non-saturated, buoyant jets rising through a turbulent air mass.** Woods Hole Oceanographic Institution, Contract N6onr-27702, Project NR-082-021, Technical Report, No. 20, Aug. **1952.** 15 p. 4 tables, 4 figs., 4 refs. **DWB**—Extension of entrainment equation of HOUGHTON and CRAMER (*Journal of Meteorology,* 8(2):75–102, 1951) in order to include the effects of diffusion of heat and momentum and the frictional pressure drag on convective jets. Theory tested by observations made at the Brookhaven meteorological towers. Observed survival of convective jets throughout the ground layer discussed. *Subject Headings:* **1. Convection 2. Turbulent exchange. I. Woods Hole Oceanographic Institution II. Contract N6onr-27702.**—*A.A.*

**4B–298** 551.551:551.511

Chandrasekhar, S., **On turbulence caused by thermal instability.** *Royal Society of London, Philosophical Transactions, Ser. A,* 244(884):357–384, March 11, **1952.** 3 tables, 24 refs., 226 eqs. **DWB**—A statistical theory of turbulence, caused by the joint effects of gravity and thermal instability, is developed. Restriction to a portion of the fluid far from the bounding surfaces permits treatment as approximately homogeneous and axisymmetric. A fundamental set of solutions governing stationary turbulence is obtained, varying periodically in the vertical. These show that eddies have a minimum wave-length depending on the physical parameters and the temperature gradient. The field of turbulence can be analyzed into two modes characterized by the kinetic energy being confined principally to the vertical or horizontal direction. (*Same item as* 3.8–82, Aug. 1952, *MAB.*) *Subject Headings:* **1. Statistical theory of turbulence 2. Instability.**—*From author's abstract.*

**4B–299** 551.551:551.524.1

Chapman, Sydney (*Queens College, Oxford*), **Thermal diffusion.** *Maryland. University. Institute for Fluid Dynamics and Applied Mathematics, Lecture Series*, No. 19, **1952.** 23 p. **DWB**—This lecture contains a survey of the history of research on diffusion with special emphasis on thermal diffusion. Leading scientists in the field are mentioned, their contributions to current knowledge summed up and their theories outlined. *Subject Headings:* **1. Turbulent diffusion 2. Lecture series.**—*G.T.*

**4B–300** 551.551

*Cramer, H. E. and Record, F. A., **Measurements of the structure of turbulent flow at a height of 2.3 meters.** Massachusetts Institute of Technology. Round Hill Field Station, Contract AF 19(604)-145, Scientific Report, No. 1, Aug. 1, **1952.** 78 p. 9 figs., 4 tables, p. 13–78 entirely tables, 15 refs., appends. **DWB**—Detailed data are presented for wind speed, wind direction, air temperature and eddy velocities for six periods of observations each approximately 7 min. long. Frequency distribution shown. Standard deviation ($\sigma$) of velocity fluctuations increases with wind speed, $\sigma$ of temperature fluctuations increases with gradient of potential temperature. Unfortunately, the observation distances were too short to determine the scale of turbulence. The spatial correlation function decreases faster across wind than along wind in all cases. Shearing stress decreases sharply at night. *Subject Headings:* **1. Turbulence statistics 2. Atmospheric turbulence. Massachusetts Institute of Technology. Round Hill Field Station II. Contract AF 19(604)-145**—*A.A.*

**4B–301** 551.551:533.17

Frenkiel, François Naftali, **Application of the statistical theory of turbulent diffusion to micrometeorology.** *Journal of Meteorology*, 9(4):252–259, Aug. **1952.** 8 figs., table, 10 refs., 25 eqs. **DWB**—The differences between observed wind tunnel and natural microturbulence are reviewed. A statistical description of a turbulent field is given and the turbulent-diffusion equation set out in terms of time history of a spherical cloud dispersing from a point source, the intensity of turbulence not being small in comparison with mean velocity. "The relation between FICK's differential equation of diffusion and the statistical theory of turbulence is studied, and the limits of validity of FICK's equation are determined." *Subject Headings*: **1. Micro turbulence 2. Statistical theory of turbulence 3. Turbulent diffusion.**—*C.E.P.B.*

**4B–302** 551.551:551.510.42

*§Georgii, Hans-Walter, **Investigaciones del contenido del polvo atmosférico en la Provincia de Mendoza.** [Investigations of the dust content of the atmosphere in Mendoza Province.] *Mendoza, Argentina. Universidad Nacional de Cuyo. Departamento de Investigaciones Científicas, Anales*, 1(1):71–91, **1952.** 5 tables, 13 figs., 9 refs. In Spanish, Spanish and German summaries. **DWB**—Dust counts made with a Zeiss konimeter were recorded in the free air at 3 places in Mendoza, Argentina, and vicinity in the spring of 1951 (Oct. to Dec.) at 10 h and 15 h. The effect of the Zonda is shown by comparing measurements before and during the storm. Synoptic charts and recorder records of pressure, temperature and humidity during the period of the Zonda are reproduced. Vertical distribution of temperature and of dust to 4 km is shown, and a cross section to 7 km shows the schematic structure of atmospheric conditions in respect to topography and dust. The coefficient of vertical diffusion or austausch is calculated on the basis of airplane soundings of temperature and dust content. *Subject Headings:* **1. Turbulent diffusion 2. Atmospheric pollution 3. Dust 4. Turbulent exchange 5. Zonda winds 6. Mendoza, Argentina.**—*M.R.*

**4B–303** 551.551.59:613.15

Gregory, P. H. and Hirst, J. M., **Possible role of Basidiospores as airborne allergens.** *Nature*, London, 170(4323):414, Sept. 6, **1952.** fig., 4 refs. **DLC**—Daily mean numbers of basidiospores (minute fungal spores) were observed at 2 m above a potato plot at Rothamsted, England, Aug. through Sept. 1951. Some types increased after rain, possibly through liberation after wetting of fungal surface. On dry days early morning frequency is 5–6 times that in afternoon, due to less rapid dilution of spore cloud by turbulence. *Subject Headings:* **1. Turbulent diffusion 2. Air-borne diseases.**—*C.E.P.B.*

**4B–304** 551.511

Hempstead, Mabel S., **The probable error inherent in the determination of the turbulent heat flow in the atmosphere by a recording computer.** Woods Hole Oceanographic Institution, Contract N6onr-27703 (Nr-082-021), Technical Report No. 19, July **1952.** 21 p. 5 tables, 2 figs., 2 refs. **DWB**—An equation is derived which relates the probable errors of the individual determinations involved in the calculation of the turbulent heat flow to the probable error of the value of the turbulent heat flow itself. It is shown that the probable error of any turbulent heat flow determination

is approximately +0.002 cal/cm²/sec and is largely dependent on the calibration errors. The major source of error is to be found in the recording rather than in the integrating mechanism. *Subject Headings:* **1. Turbulence measurement 2. Turbulent transfer of heat. I. Woods Hole Oceanographic Institution II. Contract N6onr-27703 (Nr-082-021).**—*From author's abstract.*

**4B–305** 551.551.2

Höhndorf, Fritz, **Zur Böigkeit auf dem Hohenpeissenberg.** [On gustiness on the Hohenpeissenberg.] *Germany. Deutscher Wetterdienst in der US Zone, Berichte*, No. 38:394–396, **1952.** 4 figs., 5 refs. **DWB**—The observatory is on a ridge sloping steeply to south and gently to east. Northerly winds are much more turbulent than easterly and southwesterly. Causes are discussed and wind roses given to show dependence of gustiness on wind speed and direction. *Subject Headings:* **1. Gustiness 2. Hohenpeissenberg, Germany.**—*C.E.P.B.*

**4B–306** 551.511:551.551

Inoue, Ei-ichi; Lettau, Heinz, **Some remarks on Lettau's new theories of the atmospheric surface layer.** *Journal of Meteorology*, 9(3):224–226, June **1952.** refs., 9 eqs. **DWB**—INOUE criticizes LETTAU's recent theories of turbulence and diffusion in surface layer (*see item* 7–37, July 1950, *MAB*). LETTAU replies. *Subject Headings:* **1. Turbulence theory 2. Turbulent diffusion.**—*C.E.P.B.*

**4B–307** 551.551

Inoue, Ei-ichi, **Some remarks on the vertical diffusion of smoke near the ground.** *Meteorological Society of Japan, Journal*, 30(7):216–222, July **1952.** refs., eqs. In Japanese, English summary p. 216. **DWB**—The transient and ultimate states of the vertical diffusion width of smoke in the wind near the ground are dealt with. Reference is made to the work of F. A. RECORD (1951) and O. G. SUTTON (1950). *Subject Heading:* **1. Smoke diffusion.**—*M.P.K.*

**4B–308** 551.551 551.46

Inoue, Ei-ichi (*National Inst. of Agricultural Sciences, Tokyo*), **Turbulent fluctuations in temperature in the atmosphere and oceans.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 30(9): 289–295, Sept. **1952.** fig., 16 refs., 3 eqs. **DWB**—Several statistical quantities such as the intensity and correlation coefficients of temperature fluctuations in the atmosphere and oceans are theoretically derived from thermal similarity hypotheses of two different kinds which give the $-7/3$ and the $-5/3$ power law of fluctuation spectrum, respectively. Relations between statistical quantities and the averaging procedures in observation are given in two different forms following either hypothesis. Observational results seem to support the $-7/3$ power law rather than the $-5/3$ power law. *Subject Headings:* **1. Turbulence statistics 2. Atmospheric turbulence 3. Oceanography.**—*Author's abstract.*

**4B–309** 551.551

Ishida, T., Kusunoki, K., Asada, H. and Imai, H., **Measurement and analysis of atmospheric turbulence.** *Journal of Meteorological Research*, Tokyo, 4(3):259–274, March **1952.** 25 figs., 14 tables, 3 refs., 9 eqs. In Japanese, English summary p. 338. **MH-BH**—Data presented in this paper include spectra of the horizontal and vertical component of wind velocity measured over a forest up to 60 m above the ground, and values of the horizontal and vertical austausch coefficients computed by K. IMAHORI's method. The heterodyne frequency analyzer used in these measurements is described and illustrated in a diagram. *Subject Headings:* **1. Turbulence measurement 2. Turbulent exchange 3. Turbulence in the frictional layer.**—*G.T.*

**4B–310** 551.551 551.524.4

Ito, N., **The eddy diffusion near the earth's surface at Ochiishi.** *Journal of Meteorological Research*, Tokyo, v. 4, *Suppl. Number*, p. 75–76, March **1952.** 2 figs., 4 eqs. In Japanese, English summary p. 325. **MH-BH**—The author determined the eddy diffusion coefficient by measuring the vertical distribution of temperature from the earth's surface to 60 km. It always increases with height, and its order is $10^4$–$10^6$ C.G.S. in the daytime and $10^3$–$10^4$ C.G.S. at night. *Subject Headings:* **1. Turbulent diffusion 2. Turbulence in the frictional layer 3. Vertical temperature gradient.**—*Author's abstract.*

**4B–311** 551.551 551.510.42

Kliugin, S. A., **O raschete kontsentratsii gazov, vydeliaemykh promyshlennymi predpriiatiiami.** [Calculations of the concentration of gases produced by industrial establishments.] *Gigiena i Sanitariia*, Moscow, No. 1:15–20, **1952.** 3 figs., 2 tables, eqs. **DLC**—Formulas (based upon the principles of turbulent diffusion) for concentrations of atmospheric contaminants at any distance

from the source are given. Formula for determining the maximum concentration from the foundation of the stack: (1) $XC_{max} = \frac{Z_1}{S_1}$ m, where $C_{max}$ = max. concentration, $Z_1$ = height of stack plus height of gases above stack, $S_1$ = atmospheric turbulence coefficient, $X$ = distance; (2) $C_{max} = \frac{G}{8.5 \cdot \nu \cdot z^2}$ mg./m³, where $C_{max}$ = max. concentration, $G$ = amount of matter ejected in mg./sec., $\nu$ = wind velocity at height of ejection in m/sec. *Subject Headings:* **1. Atmospheric pollution 2. Industrial waste gases 3. Turbulent diffusion.**—*I. L. D.*

**4B–312** 551.524.4:551.524.1

Krechmer, S. I., **Issledovanie mikropul'satsiĭ temperaturnogo polia v atmosfere.** [Investigations of micropulsations of the atmospheric temperature.] *Akademiia Nauk, SSSR, Doklady*, 84(1):55–58, **1952.** 4 figs., 11 refs. **DLC**—The author describes, with the aid of a diagram, the structure of an apparatus for measuring turbulent pulsation of atmospheric temperature which has a sensitivity of 0.01° for 1 mm of scale magnitude per 0.01 second, and which can measure synchronously temperature pulsations along the vertical. It consists of a resistance thermometer and temperature pulsations are measured with a Wheatstone bridge. Measurements were made at two points at elevations ranging from 0.5 to 32 cm. An empirical expression for the mean absolute temperature difference between two points was obtained, namely $\overline{\Delta T} = Bl^{\frac{1}{3}}$ ($B = 3.10^{-2°}$ cm$^{-\frac{1}{3}}$; $l$ = height). By means of this formula, it becomes possible to measure directly turbulent flow using the expression $q = c_p \rho \overline{WT}'$. *Subject Headings:* **1. Temperature micro-oscillations 2. Turbulence measurement 3. U.S.S.R.**—*I. L. D.*

**4B–313** 551.511

Lettau, Heinz, **Austausch.** (In: Landolt, Hans Heinrich and Börnstein, Richard, **Zahlenwerte und Funktionen aus Physik, Chemie, Astronomie, Geophysik und Technik.** 6 ed. Berlin, Springer, **1952.** v. 3. p. 666–674. 5 figs., 7 tables, 32 refs., 19 eqs.) **DWB**—A most valuable, concise review. Basic definitions are given (austausch, transport of properties, "resorption zone," surface layer, shearing stress and mixing length) and a strong distinction between the dynamic and the thermic component of exchange. Basic information is given on roughness parameters, dependence of exchange on height and wind profiles. Most interesting is the discussion of the thermal component in which the author summarizes the results of his own research, especially on the diurnal variation of austausch and compares them with results of observations made by THORNTHWAITE and KASER. The thermal component of austausch is: $A/A_a = 1/(1 + Le)^2$, $A$—austausch at surface heating, $A_a$—in adiabatic state; $Le = g\theta' {l_a}^2 / \theta_m \overset{*}{w_a}^2$, the first Lettau criterion; $g$—acceleration of earth gravity; $\theta'$—vertical gradient of potential temperature; $l_a$—mixing length for the adiabatic case; $\theta_m$—average potential temperature for the studied case; $\overset{*}{w_a}^2$—mixing velocity for the adiabatic case. More convenient is the use of the second Lettau criterion: $LE = -Le/(1 + Le)^2$. Probable critical value for convection $Le = -1$. Characteristic values of $A/\rho$ are given for the free atmosphere up to 100 km. *Subject Headings:* **1. Atmospheric turbulence 2. Austausch theory 3. Convection.**—*A. A.*

**4B–314** 551.511:551.551

Logvinov, K. T., **Dinamicheskaia meteorologiia.** [Dynamic meteorology.] Leningrad, Gidrometizdat., **1952.** 148 p. 42 figs., 6 tables, 28 refs., numerous eqs. **DLC**—A short course in the aspects of dynamic meteorology which are necessary for the intelligent analysis of synoptic charts or the preparation of forecasts. It is based on the concept of a turbulent atmosphere. Several pages are devoted to this aspect and Chap. 7 (p. 101–115) entitled "Atmospheric turbulence and internal friction in the atmosphere" gives the history of quantitative measurement of turbulent elements (Reynolds and Richardson criteria), the formula for turbulent exchange, application of theory of turbulence to transfer of momentum, wind profile and change of coefficient of turbulent exchange with height. Many other applications of the concept are developed in this handy reference book. *Subject Headings:* **1. Turbulence measurement 2. Turbulence theory 3. Turbulent exchange 4. Atmospheric turbulence.**—*M. R.*

**4B–315** 551.551 551.508.53/4

Ogura, Y. (*Tokyo Univ.*), **Relations between the length of time under analysis and the statistical quantities of the atmospheric turbulence.** *Meteorological Society of Japan, Journal, 2nd Ser.*, 30(3):103–111, March **1952.** 8 figs., 7 refs., eqs. Review by R. S. Scorer in: *Applied Mechanics Review*, 5(12):542, Dec. **1952. DLC**—A useful paper showing that the statistical quantities of atmospheric turbulence obtained by observations within a finite time depend considerably on the time interval. The theory of this phenomenon is given and compared with observed data. An application to the comparison of the fluctuation records obtained with various anemometers is

presented. Low-sensitive anemometers give the same results as overlapping means. *Subject Headings:* **1. Turbulence statistics 2. Anemometers. I. Scorer, R. S.**—*A.A.*

**4B–316** 551.511:551.551

Ogura, Y., **The theory of turbulent diffusion in the atmosphere (II).** *Meteorological Society of Japan, Journal, 2nd Ser.*, 30(2):53–58, Feb. **1952.** fig., 2 refs., eqs. **MH-BH**—In this paper the author treats theoretically how the essential features of atmospheric diffusion appear to be remarkably dependent upon the duration of time $T^*$ during which the phenomenon is observed. $T^*$ is called the averaging time. This problem is considered in view of extending the author's previous study, in which only the case of $T^* = \infty$ was discussed. The most important difference between the present and previous considerations is that in the present one, the eddies smaller than those of a certain scale related to the averaging time only, are considered to be relatively effective for the turbulent diffusion, while in the latter all eddies were considered to be so irrespective of their scale. *Subject Headings:* **1. Turbulence theory 2. Turbulent diffusion.**—*Author's abstract.*

**4B–317** 551.551

Panofsky, H. A., **The cooperative turbulence study of August 30–31, 1951, at the Brookhaven National Laboratory.** Pennsylvania. State College. Mineral Industries Experiment Station, Contract AF 19(604)-166, June 15, **1952.** 49 p. 10 tables, 10 figs., 6 refs., 15 eqs. **DWB**—Two completely different sets of instruments and airplane soundings were used for measurements of surface stress, heat flux, turbulent kinetic energy, exchange coefficient etc. Magnitudes obtained by different instruments may differ widely. Exchange coefficient for heat was nearly constant with height, the coefficient for momentum increased rapidly. Working hypothesis for turbulence spectrum discussed and improved in order to fit the observations and to agree with the Eisenberg-Kolmogorov theory for high frequencies. *Subject Headings:* **1. Turbulence statistics 2. Turbulence measurement 3. Turbulence spectrum. I. Pennsylvania. State College. Mineral Industries Experiment Station II. Contract AF 19(604)-166.**—*A.A.*

**4B–318** 551.551:551.507.321

Pélegrin, Marc, **Mesure de la turbulence atmosphérique.** [Measurement of atmospheric turbulence.] *Académie des Sciences, Paris, Comptes Rendus*, 235(1):19–21, July 7, **1952.** figs., refs. **DWB**—It was found that local turbulence does not noticeably affect movement of a spherical balloon, which only responds to average wind speed. A balloon considered as a fixed point in respect to minor movements of the atmosphere was equipped with hot-wire anemometers placed at opposite points, with a galvanometer, altimeter, clockwork, compensating elements and parachute equipment. Autocorrelation coefficients of the different instruments serve as a basis for determining speed and direction of turbulent motion. Practical application of the method provided useful records, a sample of which is presented. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulence measurement.**—*G.T.*

**4B–319** 551.511:551.551

†Priestley, Charles Henry Brian and Sheppard, Percival Albert, **Reviews of modern meteorology —7. Turbulence and transfer processes in the atmosphere.** *Royal Meteorological Society, Quarterly Journal*, 78(338):488–529, Oct. **1952.** 5 figs., 116 refs., 45 eqs. **DWB**—This comprehensive review aims at "an account of the (statistical) properties of atmospheric turbulence, of the factors controlling its nature and intensity, and of its effects . . . in the form of transfers of momentum, mass and energy." It deals first with the onset, stability and characteristics of turbulence—transition from laminar to turbulent flow, specification of turbulence, effect on mean motion, stability of laminar and turbulent flow, and observed features of boundary-layer and free-air turbulence. The authors then take up the mechanism and measurement of eddy transfer, and the application of transfer theory to such problems as fog formation, diurnal temperature variation, evaporation, diffusion from point, line and area sources, and integration of the differential equations in flux at a boundary, e.g. between atmosphere and sea or land, with a discussion on transfer of momentum. Section V studies diffusion of particles, including the work of TAYLOR, RICHARDSON and SUTTON. Finally, current studies of structure are summarized, including similarity and energy transfer. *Subject Headings:* **1. Turbulence measurement 2. Turbulence theory 3. Turbulent diffusion.**—*C.E.P.B.*

**4B–320** 551.551:551.508.59

Sartor, J. D., Katz, I. and Katz, R. E. (*Nat. Res. Lab., Wash., D. C.*), **A mobile method for measuring atmospheric diffusion.** *American Meteorological Society, Bulletin*, 33(5):188–194, May **1952.** 8 figs., 11 refs., eqs. **MH-BH**—The unusually low attenuation rates from long range, 9 cm, radar propagation is attributed to high (up to 10,000 ft) atmospheric scatterers which are turbulent eddy cells of varying local gradients of temperature and moisture. In order to confirm the existence of these cells and to estimate their dissipation the authors developed a portable method of measuring

diffusion by means of smoke puffs produced by smoke puff generators attached to balloons at varying altitudes and photographing them with two motion picture cameras. The coefficient of diffusion is calculated from the growth of the area of the puff and the distance it travels. An analysis of the theory of diffusion applied to smoke puffs is presented and it is shown that data of preliminary experiments agree with values published by SUTTON. Photographs and circuit diagram of the puff generator are given and its operation is described. *Subject Headings:* **1. Turbulent diffusion 2. Diffusion measurement.**—*I. L. D.*

**4B–321** 551.551

Schellenberger, Günter, **Zur Verteilung radioaktiver Substanzen in einem turbulenten Windfeld.** [On the distribution of radioactive substances in a turbulent wind field.] *Zeitschrift für Meteorologie*, 6(8):225–231, Aug. **1952.** 2 figs., 8 refs., eqs. **MH-BH**—The diffusion of an emanation gas in the turbulent atmosphere from a linear or point source is studied, using ERTEL's differential equation of exchange and considering the decay constant and concentration of the emanation. The solution can be used in unsteady cases starting with 100 m from the source. As a steady case the vertical distribution of emanation is derived theoretically as a function of the exchange coefficient $\eta$. Assuming $\eta = 50$ [g. cm.$^{-1}$ sec.$^{-1}$] the height of half value ($h$) is found for *Ra* (*A,B,C*) $h \times 1100$ m, *Ra* (*D,E,F*) practically no vertical decrease in the troposphere, emanations of *Th* and *Ac* $h \approx 14$ and 4 m, *Th* (*B,C . . .*) $h \approx 300$ m, *Ac* (*B,C . . .*) $h \approx 80$ m. *Subject Headings:* **1. Turbulent diffusion of radioactive substances 2. Turbulence theory.**—*A. A.*

**4B–322** 551.551:551.554

§Sherlock, R. H., **Variation of wind velocity and gusts with height.** *American Society of Civil Engineers, N. Y., Proceedings*, v. 78, Separate No. 126, April, **1952.** 26 p. 12 figs., 7 eqs., refs. **DLC**—EKMAN's theory of wind velocity variation with height is reviewed. Ekman spirals, observed wind velocity (recorded during winter storm in 1933 on 250 ft steel tower) and computed gradient wind are compared graphically. It is found that the seventh-power law is a sufficiently close approximation to the theoretical curve up to only 1000 or 1500 ft above which a constant velocity should be used. Gust factors important for structural design are described. Charts show microstructure of wind in lowest 250 ft of atmosphere. *Subject Headings:* **1. Turbulence in the frictional layer 2. Ekman's spiral 3. Wind profiles 4. Gustiness.**—*M. P. K.*

**4B–323** 551.551

Swinbank, W. C. and Richardson, L. F., **The criterion of atmospheric turbulence.** *Royal Meteorological Society, Quarterly Journal*, 78(337):420–425, July **1952.** refs., eqs. **DWB**—SWINBANK regards Richardson's criterion for increase or decrease of kinetic energy of atmospheric turbulence (1920) as fallacious, and discusses application of Reynolds' concepts to the atmosphere. RICHARDSON replies emphasizing the difficulties of the subject and includes a useful list of references. *Subject Headings:* **1. Atmospheric turbulence 2. Richardson criterion.**—*C. E. P. B.*

**4B–324** 551.511:551.551

Taylor, R. J., **The dissipation of kinetic energy in the lowest layers of the atmosphere.** *Royal Meteorological Society, Quarterly Journal*, 78(336):179–185, April **1952.** 3 tables, 9 refs. **DLC**—Author calculates the flux of kinetic energy into the top of a shallow layer of air bounded below by a uniform horizontal ground surface, using observations by SWINBANK and DEACON (unpublished). Values of energy dissipation per unit mass are calculated for levels of 1–50 m and found to account for over $\frac{1}{4}$ of the observed rise of temperature 2 to $\frac{1}{2}$ m. The size of the eddies which give the greatest dissipation of energy is calculated from expressions by RICHARDSON and G. I. TAYLOR giving lengths of 2–9 cm at 2 m height. (*Same item as* 3.8–83, Aug. 1952, *MAB.*) *Subject Headings:* **1. Atmospheric turbulence 2. Turbulence theory.**—*C. E. P. B.*

**4B–325** 551.551 551.511

Theodorsen, Theodor, **Mechanism of turbulence.** Second Midwestern Conference on Fluid Mechanics, March 17, **1952.** Original unchecked. Review by author in: *Journal of the Aeronautical Sciences*, N. Y., 19(9):645, Sept. **1952. DLC**—The theory is advanced that the collapse of a large-scale boundary layer of considerable horizontal extension and the subsequent formation of a huge vortex is responsible for the genesis of hurricanes. *Subject Headings:* **1. Atmospheric turbulence 2. Boundary layer 3. Hurricanes.**—*M. P. K.*

**4B–326** 551.573:551.584:551.508

*Thornthwaite, Charles Warren (*comp.*), **Micrometeorology of the surface layer of the atmosphere.** Johns Hopkins University, Laboratory of Climatology, Seabrook, N. J., Contract W28-099-ac-378, Interim Reports Nos. 1–18, **1948–1952.** figs., mostly tables, eqs. Index in Final Report, June 30, 1952. **DWB**—One of the most important experimental contributions to the study of the

interaction between soil and atmosphere, containing some 1600 pages of data and discussions. Current data include: maximum and minimum temperatures and daily precipitation for Seabrook and a network of some 50 stations on the Cape May Peninsula, potential evapotranspiration, soil moisture and temperature, hourly precipitation, wind speed, total solar radiation and net radiation exchange, but no current measurements of atmospheric humidity. Micrometeorological simultaneous profiles (temperature, humidity, soil temperature, wind) as well as smoke puff data are given for 107 single days in short time intervals from 80 up to 640 cm height. Special attention was paid to the design of micrometeorological instruments (thermocouples, Thornthwaite's automatic and potable dew point indicator, anemometers, energy balance indicators, pyrheliometers, radiometers, evapotranspirometers, tensiometers, etc.). Careful calibration and error sources discussed. A battery of 6 to 7 basic and a dozen modified evapotranspirometers was maintained in order to study potential evapotranspiration and the relation of soil moisture to the growth of plants. A series of some 20 articles is devoted to theory of turbulence and its verification, turbulent transfer of heat and moisture, shear stress, evapotranspiration and design of micrometeorological instruments. *Subject Headings:* **1. Micrometeorological data 2. Micrometeorological profiles 3. Micrometeorological instruments 4. Evapotranspiration 5. Atmospheric turbulence 6. Seabrook, N. J. I. Johns Hopkins University. Laboratory of Climatology, Seabrook, N. J. II. Contract W28-099-ac-378.** —*A.A.*

**4B–327** 551.511:551.551

Yih, Chia-shun, **Atmospheric diffusion from a line and point source of mass above the ground.** Colorado Agricultural and Mechanical College, Civil Engineering Dept., Contract N9onr-92401, NR 063-071/1-19-49, Report, No. 6, April **1952.** 9 p. 3 refs., 18 eqs. **DWB**—Under the assumption that the wind velocity and the diffusivities vary as certain power functions of height, the mass distribution in the atmosphere resulting from a line or point source above the ground is calculated. It is obvious that the result obtained has a direct bearing on the problem of smog control. *Subject Headings:* **1. Atmospheric turbulence 2. Turbulent diffusion 3. Smog. I. Colorado Agricultural and Mechanical College. Civil Engineering Depart. II. Contract N9onr-82401, NR 063-071/1-19-49.**—*Author's abstract.*

**4B–328** 551.551:551.511

Yih, Chia-shun, **On a differential equation of atmospheric diffusion.** *American Geophysical Union, Transactions, 33*(1):8–12, Feb. **1952.** 3 refs., 26 eqs. **DWB**—The author generalized the differential equation of SUTTON for the vapor diffusion, assuming that the powers in the power distribution of the mean velocity and the exchange coefficient are independent. He discusses the following cases: 1) diffusion from a line-source embedded in a smooth surface; 2) diffusion from a smooth surface; 3) vapor concentration in the wake of an evaporating surface. The diffusion in COUETTE flow is given as an example. The solutions are complicated and can be computed with the aid of gamma functions. *Subject Headings:* **1. Turbulent diffusion I. Sutton, O. G.**—*A.A.*

## SUPPLEMENTARY MATERIAL

**4B–329** 551.524.4:551.551

Johnson, Sir Nelson K. and Heywood, G. S. P., **An investigation of the lapse rate of temperature in the lowest hundred metres of the atmosphere.** *Great Britain. Meteorological Office, Geophysical Memoirs,* No. 77, **1938.** 50 p. 19 figs., 31 tables, 12 refs. **DLC**—One of the more important experimental contributions to our knowledge of the air layer near the ground. Observations were made during five years with aspirated resistance thermometers on the radio mast at Leafield, Oxon. Mean and maximum hourly values of lapse rate are given for each month and all days combined, as well as for clear days in June and Dec. and overcast days in Dec. The frequency distribution of lapse rates is shown. An attempt is made to compute the intensity of atmospheric turbulence and its variation with height on the basis of diurnal temperature variations. The effects of wind speed on lapse rate and turbulence are discussed as well as short period temperature variations, the "radiation temperature structure" and radiation fog. *Subject Headings:* **1. Vertical temperature gradient 2. Atmospheric turbulence 3. Tower observations 4. Leafield, England.**—*A.A.*

**4B–330** 551.5(02) 551.551

Byers, Horace R., **General meteorology.** 1st ed. New York, McGraw Hill, **1944.** 645 p. 300 figs., 26+17 tables, refs. Author and subject index. **DWB**—Chapter 24, entitled "Atmospheric turbulence and the wind structure near the surface of the earth" (p. 587–606), contains the most lucid treatment of the essential theory of atmospheric turbulence (as applied to motions and diffusion in the lower atmosphere, and as determined from aerological data) to be found in any

tandard text. The development of the austausch concept from earlier observations on the wind tructure is traced historically. More recent ideas introduced by the hydrodynamicists (like Rossby) are also expounded. *Subject Headings:* **1. Wind structure 2. Atmospheric turbulence 3. Textbooks.**—*M.R.*

**4B–331** 551.573:551.551:016

†Budyko, M. I., **Isparenie v estestvennykh usloviiakh.** [Evaporation under natural conditions.] Leningrad, Gidromet. Izdat., **1948,** 135 p. 26 figs., 8 tables, 235 refs., 107 eqs. **DLC**—Without slighting the importance of the contributions of Russian and especially of Soviet workers in this broad field the author has, in this technical monograph, summarized and organized the results of a vast amount of native and foreign research (both theoretical and practical) on evaporation and turbulent exchange from the soil and from water surfaces. The literature cited covers the entire period of instrumental investigations into the laws governing evaporation, from Halley (1687–1694), Richman (1744–1751) and Wild (1874) to Prandtl (1944) and Sheppard (1947) on one hand, and Budyko (1945–1948), Laĭkhtman (1947), Abukhov (1946) and IUdin (1940–1948) on the other. The several chapters consist of detailed treatment of: 1) equations of heat and moisture balance of the surface layers and the physiogeographical relationship of moisture and heat exchange; 2) progress in research along these lines to date; 3) characteristics of the lower layer of the atmosphere and depth of this "microclimatic" layer; 4) turbulence lapse rates and convection in the ground layer; 5) influence of soil conditions and ground cover on evaporation; 6) methods of measuring or calculating natural evaporation; 7) dependence of evaporation on meteorological elements; 8) heat and moisture balance at the ground in European U.S.S.R. and over the whole earth. The bibliography of 235 refs. contains about 110 from Russian literature; the rest from foreign sources. (*Same item as* 3.7–153, July 1952, *MAB.*) *Subject Headings:* **1. Evaporation 2. Turbulent exchange 3. Energy exchange 4. Bibliographies 5. History of meteorology.**—*M.R.*

**4B–332** 551.524.4:551.584:551.551

Gerhardt, John R. and Gordon, William E., **Microtemperature fluctuations.** Texas. University. Electrical Engineering Research Laboratory, Contract N6onr-266, T.O. 2, Report No. 19, March 15, **1948.** 14 p. 7 figs., 11 refs., 4 eqs. **DWB**—Selected portions of microtemperature data obtained continuously and with near simultaneity at several levels up to 6 ft over desert surface are plotted on expanded height-time coordinates. The resulting isotherm patterns are shown to be strikingly consistent at all levels and are qualitatively analyzed as a function of the turbulence field present. Correlation coefficients between temperature fluctuations simultaneously at two levels and at a point for various time intervals are evaluated and their variation with separation, time, wind speed and thermal stability is discussed. Tentative intensity and scale measures of turbulence derived from temperature data are presented. *Subject Headings:* **1. Temperature profiles 2. Micrometeorological data 3. Atmospheric turbulence. I. Texas. University. Electrical Engineering Research Laboratory II. Contract N6onr-266, T.O. 2.**—*Authors' abstract.*

**4B–333** 551.508:551.501:551.551(02)

†Gol'tsman, M. I., **Osnovy metodiki aerofizicheskikh izmerenii.** [Fundamentals of the methodology of aerophysical measurements.] Moscow, Gosizdat., **1950.** 360 p. 79 figs., 23 tables, 21 refs., eqs. **DLC**—This textbook is one of the most important works in the field of meteorology published during the past decade. Beginning with the theory of atmospheric turbulence, representativeness of observations, and accuracy of measurements due to the turbulent structure of the atmosphere as well as to instrumental characteristics, the author takes up in separate chapters the structure or nature of each of the important meteorological elements (temperature, humidity, pressure and wind), and the factors influencing the accuracy of instruments commonly used to measure each of these elements. The superiority of the performance of the resistance thermometer (platinum wire) over that of the conventional psychrometer is due to the small lag (quick response), and to nondependence of readings on solar radiation or on ventilation. True air temperature can thus be measured for instant conditions or averaged over 2–3 min. Errors in shelters amount to 2°C or 10% relative humidity whichever system is used. Curves showing probable distribution or errors and actual readings are presented for each type of instrument. A number of original instruments for measuring micrometeorological elements are described and illustrated. The appendix (p. 346–354) discusses the measurement of vertical temperature, humidity and wind gradients. A long chapter (115 pages) devoted to wind measurements takes up measurement of horizontal and vertical velocities and includes several new vertical velocity instruments developed at the Central Geophysical Observatory in Leningrad. The extensive list of references is not limited to Soviet works. (*Same item as* 4.1–3, Jan. 1953, *MAB.*) *Subject Headings:* **1. Turbulence measurement 2. Micrometeorological instruments 3. Instrument accuracy 4. Micro-oscillations 5. Textbooks.**—*A.A., M.R.*

**4B–334** 551.551

Panofsky, Hans A. and Singer, Irving A., **Turbulence studies useful in wind tunnel simulation of atmospheric conditions.** New York Univ. College of Engineering, Research Div., Contract At(30-1)-965, Consolidated Edison Wind Tunnel, Technical Report, 145.01, Progress Report, Meteorological phase, July 1, 1950 to Feb. 28, **1951.** 67 p. 14 figs., 4 tables, 5 refs., eqs. **DWB**—Summary of work done at Brookhaven, Long Island. Exchange coefficient of heat and momentum was measured and computed from the diurnal variation of temperature and the wind variation with height. Vertical and horizontal transport of momentum studied and turbulence spectrum discussed, as well as meteorological conditions governing radical changes of turbulence. Similarity considerations are made for studies in wind tunnels. *Subject Headings:* **1. Turbulence measurement 2. Turbulence statistics 3. Atmospheric turbulence 4. Brookhaven, N. Y. I. New York University. College of Engineering. Research Div. II. Contract At(30-1)-965 III. McCormick, Robert A. IV. Siffert, Raymond V. Leonard, Ernest VI. Pournaras, Stephen VII. Crutcher, Harold VIII. Wanta, Raymond.**—*A.A.*

**4B–335** 551.511:551.571

Bunker, Andrew F., **Measurements of the vertical water vapor transport and distribution within unstable atmospheric ground layers and the turbulent mass exchange coefficient.** *Papers in Physical Oceanography and Meteorology*, Cambridge, 12(3), Dec. **1952.** 42 p. 27 figs., 8 tables, 39 refs., 14 eqs. **DWB**—Measurements of temperature and humidity by means of aeroplane soundings and computation of evaporation from the sea surface and of the net transport of water vapor at many levels up to 2000 m have been made. An investigation of the coefficient of turbulent mass exchange through the entire ground layer showed its extreme variability. Accumulation of water vapor in air masses moving from land to the sea is studied. Influence of free convection evaluated. Author gives actual data and computations. Exchange coefficient increases rapidly up to 100 m, where it reaches the average value of 1350 g. $cm^{-1}$ $sec^{-1}$, and decreases slowly up to the upper limit of the ground layer in the inversion region, where it is negligibly small (1–10 g. $cm^{-1}$ $sec^{-1}$). *Subject Headings:* **1. Turbulent transfer of water vapor 2. Humidity profiles 3. Ocean—atmosphere interaction 4. Airplane soundings.**—*A.A.*

**4B–336** 551.551

Knighting, E., **On the equation of diffusion in the atmosphere.** *Quarterly Journal of Mechanics and Applied Mathematics*, London, 5(4):423–431, Dec. **1952.** 30 eqs. **DWB**—An analysis is made of the diffusion equation in two dimensions with the diffusion coefficient proportional to a power of the height above a given datum level, nominally the surface. This equation is used in meteorological problems concerning the lower atmosphere; solutions are given under the usual boundary conditions met with in these problems and solutions of particular problems are indicated. Special attention is paid to the possible values of the index in the power-law diffusion coefficient, and conclusions drawn regarding the applicability of the solutions in various cases. *Subject Heading:* **1. Diffusion equations.**—*Author's abstract.*

**4B–337** 551.511:551.524.1:551.551

Lander, A. J. and Robinson, George David, **Some observations of the small scale fluctuations of wind and temperature near the ground.** *Great Britain. Meteorological Research Committee, M.R.P.* 740, Aug. 28, **1952.** 15 p. 9 figs., 3 tables, 19 refs., eqs. Mimeographed. **DWB**—Records were made on cloudless days, wind 1–2 m/sec, 25 cm over short grass, with small vertical and horizontal hot wire anemometers and a resistance thermometer. Half hourly profiles were taken of air and earth temperature, humidity and wind, with solar radiation and fluxes of atmospheric and terrestrial radiation. Theory and errors of flux of heat and linear momentum are discussed, and the estimated fluxes, eddy conductivity and eddy viscosity tabulated. The heat flux found is 30–50% of that calculated from radiation and soil temperatures; the remainder is attributed to movements small compared with the instrument. The frequency distributions of the fluctuations are not normal and much of the heat flux is associated with large vertical currents. The turbulence is shown to be anisotropic. *Subject Headings:* **1. Heat transfer 2. Temperature microvariations 3. Eddy convectivity.**—*C.E.P.B.*

**4B–338** 551.508.51:551.551

Mazzarella, Daniel A. (*Brookhaven Natl. Lab., Upton, L. I., N. Y.*), **An all-weather, remote-recording bivane.** *American Meteorological Society, Bulletin*, 33(2):60–66, Feb. **1952.** 10 figs., 7 refs. **MH-BH**—The Bookhaven National Laboratory bivane consists of a combination of self-synchronous motors with a recorder which incorporates a time scale. The bivane can be operated for long periods of time under diverse weather conditions, and can be used to measure the horizontal and vertical components of eddies that play a role in smoke dispersal. The design and construction of the bivane are described with the aid of diagrams and photographs, and the results of tests in

both wind tunnel and on the tower (at 355 ft level) to determine period and damping coefficient of flat plane vane and annular-fin assembly are presented. In response tests the latter indicated a shorter period than the former; in damping coefficients the difference was smaller (*see also* 3.5–66, May 1952, *MAB*). *Subject Headings:* **1. Wind vanes 2. Remote recording instruments 3. Turbulence measurement. I. Brookhaven National Laboratory, N. Y.**—*I.L.D.*

**4B–339** 551.508.51:551.551

Sanuki, M., **Oscillation of wind vane in a wind fluctuating both in direction and speed.** *Geofisica Pura e Applicata*, 22(3/4):251–254, April/June **1952.** 3 figs. **MH-BH**—The equation of motion of a wind vane in a wind fluctuating both in direction and speed is integrated by the graphical method of isocline and isocurvature. Two examples are given, one for the wind fluctuating only in speed and the other for the wind fluctuating both in direction and speed. *Subject Headings:* **1. Turbulence 2. Wind vanes.**—*Author's abstract.*

**4B–340** 551.508:551.551:536.2

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# PART III. METEOROLOGICAL ARTICLES APPEARING IN RECENTLY ISSUED PUBLICATIONS

**Note:** The contents of periodicals included in this section are for information only, and will not be listed in the monthly indexes until abstracted. When material is furnished in advance of date of publication, the pagination may be omitted.

**Akademiia Nauk SSSR, Izvestiia, Seriia Geograficheskaia,** Number 1, 1952.

Dzerdzeevskiĭ, B. L.: **Puti preobrazovaniia klimaticheskikh uslovii Prikaspiia,** [Methods for changing the climatic conditions in the Caspian Region], p. 1–3.

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